UNIVERSE OF U. S. COMMERCIAL-SCALE ANAEROBIC DIGESTERS: RESULTS OF SERI/ARD DATA COLLECTION

Prepared for:

The Biomass Program Office
Solar Fuels Research Division
Solar Energy Research Institute
1617 Cole Boulevard
Golden, CO 80401

Prepared by:

John H. Ashworth, Ph.D., Yuriy M. Bihun and Michael Lazarus
Associates in Rural Development, Inc.
72 Hungerford Terrace
Burlington, VT 05401
Under SERI subcontract number 4-04096-1.

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PREFACE

This report provides an end-of-project update for the data collection component of a project titled "The Commercial Status and Potential for Farm-Scale and Industrial Anaerobic Digestion Technology." The project was funded by the Biomass Program Office of the Solar Energy Research Institute (SERI) under subcontract number 4-04096-1, as part of the U. S. Department of Energy's (DOE's) national biomass energy research program. The project began on June 1, 1984 and had two major objectives:

- summarize the commercial status of anaerobic digestion technology for converting agricultural and industrial organic wastes to fuel, electricity, process heat and valued by-products; and

- make recommendations to DOE/SERI concerning appropriate short-term research and development and technology transfer activities that will ensure full realization of the potential of anaerobic digestion in the United States.

Associates in Rural Development, Inc. (ARD) was selected by the SERI Biomass Program Office to conduct the needed documentary and field research on the universe of operating commercial-scale anaerobic digesters in the United States. This work involved:

- developing a methodology for selection of a representative sample of field sites to be visited;

- gathering and analyzing data on design problems, operating experience, system performance, energy production, economic viability and numerous other factors relevant to the anaerobic digestion industry in America; and

- offering suggestions on directions for research and development that might accelerate the commercial acceptance and growth of anaerobic digestion technologies.

This report contains the final version of the information collected and the resulting data base. It includes data gathered from 24 field site visits made by ARD staff members and ARD's subcontractors--JAYCOR and Jeff Chandler and Associates, as well as telephone conversations with the designers, owners and operators of more than 100 anaerobic digestion systems.

Thanks are due the many state agricultural engineering extension agents, digester operators, state energy officers, and digester design and construction firms for their help in

providing and constantly updating the information presented herein. Dr. Sergio Neyeloff, Ms. Laurie Gee and Mr. Steve Papelian collected much of the preliminary information through documentary research and telephone interviews. Dr. Neyeloff also assisted with site visits in the Midwest and New England.

Thanks also go to Dr. Richard Vetter of A. O. Smith for his able assistance in arranging for site visits to digester installations in Illinois, Iowa, Wisconsin and Minnesota, as well as his valuable on-site analysis. Mr. Fred Varani of A. O. Smith also freely shared his knowledge of the design and operation of stirred tank digesters. Drs. Regis Scheitauer and Marilyn Ripin supplied data from their site visits in Pennsylvania, North Carolina and Florida. Mr. Jeff Chandler arranged for a tour of more than a dozen digesters in California and provided expert commentary on the operational history, design problems, economic viability and replicability of each. Mr. Chandler also gathered on-site data for systems installed in Georgia and Florida.

A number of other individuals also provided valuable information for this data base. Special thanks go to Dr. Donald Klass of the Institute of Gas Technology for the up-to-date summary information that he supplied at the beginning of this project on the universe of anaerobic digesters in the United States. Ms. Lisa Beale Powlison edited the final version of this report.

INTRODUCTION

This report is one of a series prepared by ARD in support of the anaerobic digestion research program being conducted by SERI's Biomass Program Office. It is available on both disk and as hard copy from that office. To better understand the entries on each of the data sheets that follow, an explanatory section for each item has been reproduced from documentation on the SERI/ARD anaerobic digestion data base that appears in a companion volume, THE SERI/ARD ANAEROBIC DIGESTION DATA BASE: A GUIDE FOR OPERATION AND DATA ANALYIS (Burlington, VT: ARD; May, 1985). Observations drawn from the analysis of this data base as well as the field site visits can be found in a report titled MECHANICAL, OPERATIONAL AND MICROBIOLOGICAL PROBLEMS OF INSTALLED COMMERCIAL ANAEROBIC DIGESTERS IN THE UNITED STATES: FINDINGS FROM SITE VISITS AND INDUSTRIAL CONSULTATIONS (Burlington, VT: ARD; May, 1985).

It should also be noted that this report depends heavily on data collected as part of a follow-on SERI project titled ANALYSIS AND STRATEGY DEVELOPMENT FOR THE ANAEROBIC DIGESTION PROGRAM, SERI contract number XK-4-04149-1. Much of the follow-up work on preliminary findings and some additional on-site data collection in California was funded by this project, as part of an effort to examine matched sets of digesters to determine the key characteristics that are closely correlated with long-term design and operational success. Much of the comparative analysis of different types of systems, and the impact of various operational practices on gas output per unit volume will be discussed in a forthcoming ARD report titled DATA ANALYSIS OF THE PERFORMANCE OF INSTALLED ANAEROBIC DIGESTION SYSTEMS.

THE UNIVERSE OF U.S. COMMERCIAL-SCALE ANAEROBIC DIGESTERS

NUMBER	SITE NO.	SITE
1	AR-1	Keel Farm, Harrison, AR
2	AR-2	Fales Poultry Farm, Melbourne, AR
3	AR-3	Gillespie Egg Farm, AR
4	AR-4	Mabrey Farm, Batesville, AR
5	AZ-1	Arizona Dairy Co., AZ
6	AZ-2	Chirichua Hog Farm Partnership, Wilcox, AZ
7	CA-1	Fat City Feedlot, Gonzales, CA
8	CA-2	Micropial Products, Fairfield, CA
9	CA-3	Imperial Valley Biogasification Project, Brawly, CA
10	CA-4	Reyneveld Dairy, Arvin, CA
11	CA-5	Marindale Dairy, Novato, CA
12	CA-6	Royal Farm #1, Tulare, CA
13	CA-7	Walker Creek Farms (formerly Circle B Farms), CA
14	CA-8	Farmer Bob`s, Petaluma, CA
15	CA-9	Grant Amen Dairy, Redding, CA
16	CA-10	Langerwerf Dairy, Durham, CA
17	CA-11	J. R. Wood, Atwater, CA
18	CA-12	Sun Maid, Orange Grove, CA
19	CA-13	Foremost/McKesson, Lamore, CA
20	CA-14	Charger Stadium Wastewater Treatment, San Diego, CA
21	CA-15	Nunes Dairy, Burson, CA
22	CA-16	Luiz Dairy, Lodi, CA
23	CA-17	Fresno State Dairy, Fresno, CA
24	CA-18	Knutsen and Sons, Chico, CA
25	CA-19	Diamond S. Ranch, Waterford, CA
26	CA-20	Modesto City Wastewater Plant, Modesto, CA
27	CA-21	City of Hercules Water treatment plant,Hercules, CA
28	CO-1	Lamar, CO
29	CO-2	C.S.U Dairy Center, Fort Collins, CO
30	CT-1	Sunny Valley Foundation Farm, Milford, CT
31	FL-1	Kaplan Industrial Feedlot, Bartow, FL
32	FL-2	Jiffy Industries, Pensacola, FL
33	GA-1	Hinson Brothers, Baldwin, GA
34	GA-2	Dal-Ge Poultry Farm, Dews Pond Rd., Calhoun, GA
35	GA-3	Mathis/P&M Farm, Social Circle, GA
36	HI-1	Kona, HI
37	IA-1	Heying Enterprises, West Union, IA
38	IA-2	Naser Brothers Farm, Sibley, IA
39	IA-3	Mortimer-Rhinehart, Dallax Center, IA
40	IA-4	Morgan Mugge Farm, Greenville, IA
41	IA-5	Winterset, IA
42	IA-6	Grain Processing Corporation, Muscatine, IA
43	IA-7	Hamilton Farms, Iowa Falls, IA
44	IA-8	Harold McCabe, Mt. Pleasant, IA
45	IA-9	Gregg Farm, Easterville, IA
46	IA-10	Farmers Cooperative Elevator Co., Radcliffe, IA
47	IL-1	Leefer Farm, Carlinville, IL
48	IN-1	Joe Seyfert Farm, Huntertown, IN

NUMBER	SITE NO.	SITE
49	ME-1	Colby Coop Starch Co., Caribou, ME
50	ME-2	University of Maine Dairy Farm, Orono, ME
51	MD-1	Oak Bluff Dairy, Woodsboro, MD
52	MD-2	U.S. Naval Academy, Gambrills, MD
53	MI-1	Baum Dairy, Springport, MI
54	MI-2	Fairgrove Farms, Sturgis, MI
55	MI-3	James Allison Farm, Custer, MI
56	MI-4	Green Meadow Farm, Elsie, MI
57	MI-5	Ludington, MI
58	MI-6	Jonesville, MI
59	MI-7	Roy Thompson Farms, Mecosta, MI
60	MN-1	Lindstrom Farm, Welch, MN
61	MN-2	Larson Farm, Wyoming, MN
62	MN-3	Dennis Block, Harmony, MN
63	MN-4	American Crystal Sugar Co., East Grand Forks, MN
64	MN-5	American Crystal Sugar Co., Moorehead, MN
65	MN-6	Butterfield Farm, Hokah, MN
66	MN-7	Cerise Farm, Kellog, MN
67	MN-8	Bill St.Sauver, Scandia, MN
68	MO-1	Blue River, 7300 E. Rochester Ave., Kansas City, MO
69	MO-2	University of Missouri, Columbia, MO
70	MT-1	Montana Farms, Townsend, MT
71	NH-1	Ken Hadley`s Dairy Farm, Henniker, NH
72	NH-2	Shugah-Vale Farm, Claremont, NH
73	NJ-1	Anheuser-Busch Brewing Co. East Brunswick, NJ
74	NM-1	Big Horn Construction, Clovis, NM
75	NC-1	Darrell Smith Farm, Princeton, NC
76	NC-2	North Carolina State University, Raleigh, NC
77	NC-3	Dixie Yeast, Gastonia, NC
78	ND-1	Minn-Dak Farmers Co-op., Wahpeton, ND
79	ND-2	North Dakota State University Dairy, Fargo, ND
80	NY-1	R&M Dairy and Cheese, Hobart, NY
81	NY-2	Crown Zellerbach Co., South Glens Falls, NY
82	NY-3	Milbrook Farm, Freeville, NY
83	NY-4	Canton Ag & Tech College, Canton, NY
84	NY-5	Curtin Brothers Farm, Oneida, NY
85	NY-6	Agway Experimental Farm, Fabius, NY
86	NY-7	Ogdensburg, NY
87	OK-1	Thermonetics, Inc., Guymon, OK
88	OK-2	Braum Ice Cream Co. Dairy, Tuttle, OK
89	PA-1	Mason Dixon Farms, Inc., Gettysburg, PA
90	PA-2	Turkey Hill Dairy, Conestoga, PA
91	PR-1	Bacardi Corp., San Juan, PR
92	PR-2	Ubarri-Blanes Farm, Juana Diaz, PR
93	TN-1	Cleek Dairy Farm, Route #1, Kingsport, TN
94	TX-1	Dept. of Ag, Tarleton State Univ., Stevensville, TX
95	TX-2	Lubbock Feedlots, Lubbock, TX
96	TX-3	Celanese Chemical Co., Bishop, TX
97	TX-4	Carrell Brothers Farm, Godley, TX

NUMBER	SITE NO.	SITE
98	TX-5	Del Valle Hog Farm, Del Valle, TX
99	TX-6	Celanese Chemical Co., Vernon, TX
100	TX-7	Celanese Chemical Co., Pampa, TX
101	VT-1	Foster Brothers Farm, Middlebury, VT
102	WA-1	Department of Corrections, Monroe, WA
103	WA-2	Bill's Dairy, Bothell, WA
104	WI-1	Bob Kallian, Granston, WI
105	WI-2	Fertile Acres Farms, Rice Lake, WI
106	WI-3	Heileman Brewing Co., LaCrosse, WI
107	WI-4	Ore-Ida, Plover, WI
108	WI-5	Ripon, WI
109	WI-6	Beloit, WI

ARD Site #: AR-1 Number: 1

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Keel Farm, Harrison, AR
B. Contact Person: Colonel James Keel Phone: 501-741-6067
C. System Designer: OWN System Installer: OWN Current Status: NOP
D. Date Operational: 3/15/80 Date Non-Operational: 9/15/83

II. System Design Information:

A. Digester Type: PF Capacity 1: 121 2: -0 3: -0
B. Feedstock Type: DM Feed Quantity 1: 20 2: -0 3: -0
C. % Solids (if measured): -0 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 11 2: -0 3: -0
C. Retention Time (days): 1: -0 2: -0 3: -0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set:
C. Engine Capacity: 3 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Manufacturers of dual-fuel vehicles reluctant to sell him one unit (truck).
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Compressed biogas used to run dual-fuel truck and back-up solar water heater.
$25,000 for wind gen, solar unit, compressors; $1500 for biogas production.

VI. Economic Viability:

A. Initial Capital Cost: $ 25000.00 Other System Mod Costs: $ 1500.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:
Operator had 3 DOE grants for on-farm alternative energy projects.
Operation was a demonstration farm. When public interest waned, he shut down.

ARD Site #: AR-2 Number: 2

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Fales Poultry Farm, Melbourne, AR
B. Contact Person: Warren Fales Phone: 501-368-4587
C. System Designer: ENCY System Installer: ENCY Current Status: NOP
D. Date Operational: 7/ 1/82 Date Non-Operational: 9/15/83

II. System Design Information:

A. Digester Type: PF Capacity 1: 340 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 50000 2: 0 3: 0
C. % Solids (if measured): 8 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 339 2: 0 3: 0
C. Retention Time (days): 1: 30 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 9 per day
B. Engine/Generator Set: Waukesha/Power Specialist, Inc. (genset).
C. Engine Capacity: 85 Kw(e) Price/Kwh from Local Utility: $0.05
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.03 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Digester poorly insulated; no boiler; insufficient agitation;grit deposition.
B. Mechanical Failures:
H2S corrosion in engine interior.
C. Biological and Operational Problems:
Settling out of ground limestone and debris (wire, rocks, and feathers).
D. System and Feedstock Characteristics:
Requires a great deal of supervision to synchronize operation.

VI. Economic Viability:

A. Initial Capital Cost: $ 190000.00 Other System Mod Costs: $ 9000.00
B. Annual Op Costs: $ 54.00 Annual Returns from Power Sales: $ 1900.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
$9000 for propane/year; $54/day interest; system doesn't pay for itself.
Fales suing ENCY for poor design and maintenance of system.

ARD Site #: AR-3 Number: 3

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Gillespie Egg Farm, AR
B. Contact Person: Phone:
C. System Designer: ENCY System Installer: ENCY Current Status: OP
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 1136 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 270000 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Two 90kw generator sets.
C. Engine Capacity: 180 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
220,000 laying hens and 50,000 pullets.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Two (2) 90 kw(e) electrical gen/sets.

ARD Site #: AR-4 Number: 4

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Mabrey Farm, Batesville, AR
B. Contact Person: Ed Davis Phone: 501-371-1370
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 1/ 1/85 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 113 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 700 2: 0 3: 0
C. % Solids (if measured): 7 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: PB
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None.
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Chose water-permeable insulation - lost R-value.
B. Mechanical Failures:

C. Biological and Operational Problems:
Hard to maintain process temperature.
D. System and Feedstock Characteristics:
Designer/Installer: i/e Associates, Inc.; Only uses manure from 700 of a total of 820 farrow-to-finish hogs.

VI. Economic Viability:

A. Initial Capital Cost: $ 21000.00 Other System Mod Costs: $ 3000.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 660.00
C. Annual Value of Other Benefits: $ 1120.00

VII. R&D Needs:

VIII. Other Comments:
No electricity produced as of system start-up; $3000 modification costs to produce electricity. System not cost effective until by-products can be marketed. Benefit estimates are projections. Approximately 4200 gals. of propane saved per year; 17000 BTU's/1000 lbs. of hogs.

ARD Site #: AZ-1 Number: 5

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Arizona Dairy Co., AZ
B. Contact Person: Jim Tappan Phone: 602-833-5834
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 3/ 1/83 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 169 2: 169 3: 169
B. Feedstock Type: DM Feed Quantity 1: 120 2: 120 3: 150
C. % Solids (if measured): 20 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 1699 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 18 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Caterpillar 398 (naturally aspirated)
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
No boiler; difficult to keep digester heated.
B. Mechanical Failures:

C. Biological and Operational Problems:
Thick slurry (excessive sand and concrete) results in low gas pressure.
D. System and Feedstock Characteristics:
Round tanks avoid dead spots encountered with rectangular tanks.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Contact Jim Tappan for initial capital cost and operating costs.

ARD Site #: AZ-2 Number: 6

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Chirichua Hog Farm Partnership, Wilcox, AZ
B. Contact Person: Mr. Dick Eastman Phone: 602-384-4848
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 12/15/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: LAG Capacity 1: 13593 2: -0 3: -0
B. Feedstock Type: SM Feed Quantity 1: 950 2: -0 3: -0
C. % Solids (if measured): 5 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 642 2: -0 3: -0
C. Retention Time (days): 1: 21 2: -0 3: -0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER/OTH (FEED)

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 990 Kwh Hours of Operation: 18 per day
B. Engine/Generator Set: Caterpillar 3407 (4 cyl)/ Perennial Energy
C. Engine Capacity: 55 Kw(e) Price/Kwh from Local Utility: $0.03
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.11 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
None; still in shakedown phase.
B. Mechanical Failures:
Lead wire in electrical system shorted; minor so far.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
Design based on Royal Farms (CA-6); lagoon 1/4 covered with floating hypalon cover; H2S scrubber installed.

VI. Economic Viability:

A. Initial Capital Cost: $ 86000.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ 39000.00
C. Annual Value of Other Benefits: $ 25000.00

VII. R&D Needs:
R&D on bacteria appropriate for so. AZ climatic conditions (cool winter).

VIII. Other Comments:
Running very efficiently at start-up phase. High electrical prices primary motivation for installation of digester. Farm energy self sufficient. $10k/mo. saving on elec. bill and $3250/mo. sold to utility. $25-30k/yr for processed feed.

ARD Site #: CA-1 Number: 7

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Fat City Feedlot, Gonzales, CA
B. Contact Person: Phone:
C. System Designer: OTH System Installer: OTH Current Status: NYB
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 590 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 1500 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: OT
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
System never built, due to financing problems & fluctuating animal population
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Preliminary design was for porcelain-lined steel tanks. Biogas to be mixed with natural gas to fire steak flaker. Total feedlot pop 30,000-50,000.

VI. Economic Viability:

A. Initial Capital Cost: $ 197000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Contract cancelled; B&C getting out of digester business. Voided $91,000 grant from the California Energy Commission.

ARD Site #: CA-2 Number: 8

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Micropial Products, Fairfield, CA
B. Contact Person: Raymond P.Goebel/Jeff Chandler Phone: 916-415-0126
C. System Designer: OTH System Installer: OTH Current Status: NOP
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 40 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 180 2: 0 3: 0
D. Gas Use: GF
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Pilot scale operation only to test batch fermentation of dry manure.
B. Mechanical Failures:
none
C. Biological and Operational Problems:
Slow start up because of high solids (40%)
D. System and Feedstock Characteristics:
Gas vented; batch retention time 6 months.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:
More work on dry fermentation to reduce start-up time.

VIII. Other Comments:
Pilot scale only.
Successfully demonstrated that a dry fermenter using dry manure could start up inexpensively.

ARD Site #: CA-3 Number: 9

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Imperial Valley Biogasification Project, Brawly, CA
B. Contact Person: Kershaw & Sons Feedlot/Varani Phone: 312-439-1535
C. System Designer: BOG System Installer: BOG Current Status: NOP
D. Date Operational: 1/15/78 Date Non-Operational: 3/15/82

II. System Design Information:

A. Digester Type: MPF Capacity 1: 280 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 30000 2: 0 3: 0
C. % Solids (if measured): 8 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 12 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Grit problems; must shutdown digester and shovel grit.
B. Mechanical Failures:
Not really.
C. Biological and Operational Problems:
Run as a mesophyllic and thermophyllic digester.
D. System and Feedstock Characteristics:
30,000 head, but only one ton of manure per day is used. Horizontal metal PF tanks on skids (mobile unit) with small mixing tank. Solid feed byproduct.

VI. Economic Viability:

A. Initial Capital Cost: $ 300000.00 Other System Mod Costs: $ 50000.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:
Low pressure gas produced; 2 vol./vol./day.

VIII. Other Comments:
Mike Prokop (formerly U.C. extension) in charge. Built in Denver and trucked to CA installation. Owned by PG&E; donated to Merton Land and Cattle Company in Holtville, CA. Experimental mobile unit with a solids dryer/separator. Check data for feedstock quantity and gas production (4/4/85).

ARD Site #: CA-4 Number: 10

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Reyneveld Dairy, Arvin, CA
B. Contact Person: C.E.C. - Jeff Chandler Phone: 916-456-0126
C. System Designer: OTH System Installer: OTH Current Status: NI
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 320 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Earthen wall, in-ground digester. Summer 30% collectable; Winter 70%.
Biogas to be used for electricity to pump water for dairy operation.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Dirt lot. Manure wetted and mixed on concrete floor, eliminating mix tank.
California Energy Commission decided to cease funding.

ARD Site #: CA-5 Number: 11

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Marindale Dairy, Novato, CA
B. Contact Person: Ralph Grossi Phone: 415-897-7614
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 1/15/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 340 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 340 2: 0 3: 0
C. % Solids (if measured): 14 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 680 2: 708 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: BED AND LIQUIDS FOR FEED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 800 Kwh Hours of Operation: 20 per day
B. Engine/Generator Set: Minneapolis Moline 504/ Perennial Energy
C. Engine Capacity: 50 Kw(e) Price/Kwh from Local Utility: $0.07
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:
Original engine inefficient & required excess maintenance. Replaced 6/83.
C. Biological and Operational Problems:
Foaming required relocation of biogas takeoff.
D. System and Feedstock Characteristics:
insulated and lined earthen wall digester; designed to load very thick (14% TS) feedstock. Amount of feedstock reduced due to PIK program

VI. Economic Viability:

A. Initial Capital Cost: $ 142000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 7000.00 Annual Returns from Power Sales: $ 24000.00
C. Annual Value of Other Benefits: $ 12000.00

VII. R&D Needs:
Work on solid separators to reduce water content & increase value of sales.

VIII. Other Comments:
Effluent being extensively used. 1 yd/day of separated solids used for bedding, 3 yds/day sold @ $7/yd. Also, using solids as potting soil in experimental greenhouses and effluent liguids for heat. Using effluent liquors for heifer feeding. Waste heat from genset used for milk parlor water heating.

ARD Site #: CA-6 Number: 12

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Royal Farm #1, Tulare, CA
B. Contact Person: Ray or Dave Sharp Phone: 209-688-2052
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 4/15/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: LAG Capacity 1: 837 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 1000 2: 1200 3: 0
C. % Solids (if measured): 8 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 850 2: 1130 3: 0
C. Retention Time (days): 1: 18 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 1800 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Waukesha/Perennial Energy
C. Engine Capacity: 75 Kw(e) Price/Kwh from Local Utility: $0.07
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Using stretched cover over 1/3 of lagoon, but getting 85% of possible gas.
B. Mechanical Failures:
System has been operating 93-95% of 2.5 years of operation.
C. Biological and Operational Problems:
Since digester is unheated, reduced gas output in winter months.
D. System and Feedstock Characteristics:
Floating cover on existing aerobic lagoon converted to anaerobic digester.
System designer: Jeff Chandler.

VI. Economic Viability:

A. Initial Capital Cost: $ 89000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 40000.00
C. Annual Value of Other Benefits: $ 5000.00

VII. R&D Needs:

VIII. Other Comments:
Value of electricity displaced; $40K/yr; space heating saved $3-5k/yr.
Provides 95-110% of on-farm electrical and heat demand.
Digester gas is 69% methane. 850-1133m3 gas.
Only 5% down time.

ARD Site #: CA-7 Number: 13

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Walker Creek Farms (formerly Circle B Farms), CA
B. Contact Person: Jake Schleef/Rex Meyers (ENCY) Phone: 913-491-5300
C. System Designer: SCRO System Installer: ENCY Current Status: NOP
D. Date Operational: 10/15/81 Date Non-Operational: 10/15/83

II. System Design Information:

A. Digester Type: PF Capacity 1: 908 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 1100 2: 0 3: 0
C. % Solids (if measured): 8 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: OTH
B. Gas Prod (m3): 1: 1415 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 2040 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Caterpillar G 390
C. Engine Capacity: 85 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Screening and sedimentation process inadequate. Has too many pumps (5).
B. Mechanical Failures:
Needs new generator ($5K) & separator screen ($20K). Separator too small.
C. Biological and Operational Problems:
Material consistency a prob. for flush sys.. Hay from cow dirt clogs pumps. *
D. System and Feedstock Characteristics:
Plug-flow system, w/Hypalon cover over pit for gas storage.

VI. Economic Viability:

A. Initial Capital Cost: $ 250000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
* Wind damage to digester cover.
Current owner bought farm with digester in place & is not concerned with fixing the system.

ARD Site #: CA-8 Number: 14

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): U

A. Site Name/Location: Farmer Bob`s, Petaluma, CA
B. Contact Person: CEC Jeff Chandler Phone: 916-456-0126
C. System Designer: OTH System Installer: OTH Current Status: NYB
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: LAG Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Combined swine and calf manure feedstock.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:
Awarded grant from CEC for first swine/veal anaerobic digester operation.

VIII. Other Comments:
Farm sold before work could be started.
Awarded grant from CEC for first swine/veal anaerobic digester operation.
Digester gas 60% methane.
Information on farm operation difficult to obtain. May still be operational.

ARD Site #: CA-9 Number: 15

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Grant Amen Dairy, Redding, CA
B. Contact Person: Grant Amen Phone: 916-221-3481
C. System Designer: OTH System Installer: BOG Current Status: OP
D. Date Operational: 6/15/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 530 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 420 2: 0 3: 0
C. % Solids (if measured): 14 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: OTH
B. Gas Prod (m3): 1: 820 2: 0 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: BED/FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 1065 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Minneapolis Moline 504A (turbo)/ Perennial Energy
C. Engine Capacity: 65 Kw(e) Price/Kwh from Local Utility: $0.07
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Barns spread out. Had to build new manure collection system to feed digester
B. Mechanical Failures:
Distributor problems with genset. Difficulty operating effluent dewater.
C. Biological and Operational Problems:
Recurrent foaming required adding freeboard at top of tank.
D. System and Feedstock Characteristics:
Variable manure collection due to summer pasturing. Electrical output may drop to 35 kW(e)/hr in summer, but addition of cheese whey helps output.

VI. Economic Viability:

A. Initial Capital Cost: $ 185000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 7500.00 Annual Returns from Power Sales: $ 26000.00
C. Annual Value of Other Benefits: $ 16000.00

VII. R&D Needs:

Foaming control. Gas optimization in unmixed tank w/high (14%) solids loadg.

VIII. Other Comments:

Jeff Chandler (when w/ CEC) installed system w/ BOG as subcontractor. System working well. Planning to use biogas to operate a large persimmon dryer in future. System has solved major waste cleanup problem and generates revenue from bedding, parlor hot water, and bulk solids sales.

ARD Site #: CA-10 Number: 16

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Langerwerf Dairy, Durham, CA
B. Contact Person: Leo/Linda Langerwerf Phone: 916-342-0322
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 11/15/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 851 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 500 2: 0 3: 0
C. % Solids (if measured): 14 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 1020 2: 0 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 1800 Kwh Hours of Operation: 20 per day
B. Engine/Generator Set: Perennial Energy/Caterpillar 330C 3 phase,240 V
C. Engine Capacity: 85 Kw(e) Price/Kwh from Local Utility: $0.07
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:
Poor start-up.
D. System and Feedstock Characteristics:
430 milkers & 50-60 heifers.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 40000.00
C. Annual Value of Other Benefits: $ 7000.00

VII. R&D Needs:

VIII. Other Comments:
System designer and installer -- RCM Company(Mark Moser).
Sell 3-4 yds/day of digester solids to gardeners/nurserymen @ $5/yd.
Received low-interest loan from Cal Dept of Food & Ag.

ARD Site #: CA-11 Number: 17

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: J. R. Wood, Atwater, CA
B. Contact Person: David Hoff Phone: 209-358-5643
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 12/15/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 13250 2: 0 3: 0
B. Feedstock Type: OW Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 20000

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 6375 2: 7080 3: 0
C. Retention Time (days): 1: 4 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 9990 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Waukesha V-8 w/dual turbochargers
C. Engine Capacity: 1100 Kw(e) Price/Kwh from Local Utility: $0.06
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.06 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Very heavy solids loading w/low pH. Recirculate large % of effluent liquid.
B. Mechanical Failures:

C. Biological and Operational Problems:
Gas output fluctuation seasonally, between 6300-7100 m3/day
D. System and Feedstock Characteristics:
3-stage attached film digester w/concrete cover. Load 60,000 tons/yr wet vegetable solids into digester. 80% BOD reduction in digester w/4 day HRT.

VI. Economic Viability:

A. Initial Capital Cost: $ 1500000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 45000.00 Annual Returns from Power Sales: $ 150000.00
C. Annual Value of Other Benefits: $ 200000.00

VII. R&D Needs:
More work on attached film for vegeatable wastes and high organic concentrat.

VIII. Other Comments:
System built partly to solve odor problem, and partly to produce electricity and low pressure steam. Originally, system was set up to blend biogas and natural gas, but now switches from one to the other depending on biogas availability. Save 28% of utility elec rate for being on interruptible stats

ARD Site #: CA-12 Number: 18

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Sun Maid, Orange Grove, CA
B. Contact Person: Russell Murrey, Selma, CA Phone: 209-264-2901
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 9/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: LAG Capacity 1: 15143 2: 0 3: 0
B. Feedstock Type: AW Feed Quantity 1: 303 2: 0 3: 0
C. % Solids (if measured): 40 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 12750 2: 0 3: 0
C. Retention Time (days): 1: 30 2: 40 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: none: used as boiler fuel
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.07
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Feedstock is low pH stillage at 38 C. Use 50% effluent recycle to buffer.
B. Mechanical Failures:

C. Biological and Operational Problems:
Using proprietary microbe culture that operates well at very low pH.
D. System and Feedstock Characteristics:
Used existing aerobic lagoon, covered with hypalon cover. Took eight months to start up. 80% BOD reduction in lagoon, another 16% in aerobic polishing.

VI. Economic Viability:

A. Initial Capital Cost: $ 130000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 300000.00

VII. R&D Needs:
Want to use effluent for aquaculture, but no research currently available.

VIII. Other Comments:
Payback 3.2 months. Biogas used for boiler fuel 20-24 hrs/day. Reduced nat gas bills from $40-50k/month to $8k/month, and moving to 100% reliance on bio gas. Feedstock is stillage from production of 190 proof alcohol from raisins Since plant only works 5 days/week, weekend gas is flared.

ARD Site #: CA-13 Number: 19

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Foremost/McKesson, Lamore, CA
B. Contact Person: Robin Rodrick Phone: 415-983-8453
C. System Designer: System Installer: Current Status: OP
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: AW Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Rigid tank design.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Very hard to get information on system.

ARD Site #: CA-14 Number: 20

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): U

A. Site Name/Location: Charger Stadium Wastewater Treatment, San Diego, CA
B. Contact Person: Steve Pearson (Aqual Facility) Phone: 619-280-1015
C. System Designer: BOG System Installer: OWN Current Status: SDT
D. Date Operational: 8/15/82 Date Non-Operational: 12/15/82

II. System Design Information:

A. Digester Type: MTM Capacity 1: 75 2: 0 3: 0
B. Feedstock Type: OW Feed Quantity 1: 1000 2: 2000 3: 0
C. % Solids (if measured): 5 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Not enough hyacinths produced.
B. Mechanical Failures:

C. Biological and Operational Problems:
Hyacinth shredder/chopper ("muffin monster") gummed up and is inoperable.
D. System and Feedstock Characteristics:
Two 20,000 gallon vertical tanks. 250 gallon gas storage (ST).
1000-2000 lbs./day feed rate.
VI. Economic Viability:

A. Initial Capital Cost: $ 12000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Innovative idea-City of San Diego Wastewater Facility; start-up again 10/85.

ARD Site #: CA-15 Number: 21

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Nunes Dairy, Burson, CA
B. Contact Person: Mr. John Yerman Phone: 209-772-2461
C. System Designer: OTH System Installer: OTH Current Status: NYO
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: -0 2: -0 3: -0
B. Feedstock Type: Feed Quantity 1: -0 2: -0 3: -0
C. % Solids (if measured): -0 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: -0 2: -0 3: -0
C. Retention Time (days): 1: -0 2: -0 3: -0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set:
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:

System in design stage by Mark Moser of RCM as of April 1, 1985

ARD Site #: CA-16 Number: 22

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Luiz Dairy, Lodi, CA
B. Contact Person: Randy Luiz Phone: 209-334-0555
C. System Designer: OTH System Installer: OTH Current Status: NYO
D. Date Operational: 2/ 1/83 Date Non-Operational: 2/ 1/83

II. System Design Information:

A. Digester Type: LAG Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 800 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Waukesha Synchronous Generator
C. Engine Capacity: 150 Kw(e) Price/Kwh from Local Utility: $0.07
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
System never worked. Eccentric design,using unproved materials and concepts.
B. Mechanical Failures:
New flush system installed never worked properly.
C. Biological and Operational Problems:
Very low solids because of flush water. No effort to dewater before digest.
D. System and Feedstock Characteristics:
2 inground concrete lagoons, covered with hypalon. Mixing through inlets alog walls of lagoons. Feedstock very thin, due to large fraction of flush water.

VI. Economic Viability:

A. Initial Capital Cost: $ 300000.00 Other System Mod Costs: $ 50000.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:
Digestion and efficient mixing for flush dairy.

VIII. Other Comments:
This digester is in litigation as of April 1985. Owners charge the designer, Dieter Grabas of UNICA Corp with fraud, deceptive business practices, faulty design, etc. Owners have now brought in Mark Moser of RCM to try to redesign system and salvage operation. Will eliminate flush & use mech scraper.

ARD Site #: CA-17 Number: 23

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Fresno State Dairy, Fresno, CA
B. Contact Person: Howard Martin Phone: 209-298-8133
C. System Designer: PREN System Installer: PREN Current Status: NOP
D. Date Operational: 1/ 8/83 Date Non-Operational:

II. System Design Information:

A. Digester Type: LAG Capacity 1: 4740 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 125 2: 0 3: 0
C. % Solids (if measured): 1 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 5 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Very low soilids loading, due to excess flush water
B. Mechanical Failures:
Problems of seals for cover
C. Biological and Operational Problems:
buildup of straw & foam under cover. Insufficient gas production
D. System and Feedstock Characteristics:
Flush dairy feeding unlined existing lagoon converted to anaerobic digester. High flush rates and changing animal populations, plus turnover in student

VI. Economic Viability:

A. Initial Capital Cost: $ 30000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:
Digestion of dairy manure using very dilute substrate.

VIII. Other Comments:
Turnover in student operators, plus major problems in crusting under the floating lagoon cover, led to temporary abandonment of system. Needs redesign or way to increase solids loading.

ARD Site #: CA-18 Number: 24

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Knutsen and Sons, Chico, CA
B. Contact Person: Mark Knutsen Phone: 916-891-1517
C. System Designer: OTH System Installer: OTH Current Status: NYO
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 379 2: 0 3: -0
B. Feedstock Type: 0W Feed Quantity 1: 132 2: -0 3: -0
C. % Solids (if measured): -0 % Feedstock BOD/COD Count (mg/1): 5000

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: -0 2: -0 3: -0
C. Retention Time (days): 1: 2 2: -0 3: -0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set:
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Digester built to solve odor problems from on-site disposal ditches
B. Mechanical Failures:
none-just started up
C. Biological and Operational Problems:
Problems getting microbes to attached to plastic filter media
D. System and Feedstock Characteristics:
Anaerobic filter,using four recycled sugar tanks w/plastic attach. media.
Feedstock fruit juice factory waste, pH 5.5, 132 m3/day, temp only 10C.

VI. Economic Viability:

A. Initial Capital Cost: $ 100000.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:
Accelerated attachment for bacteria in anaerobic filter system.

VIII. Other Comments:
System designed by Culp-Wesner-Culp,Cameron Park, CA. Set up to handle up to 50,000 gallons/day of effluent, currently 35,000. System was started up very quickly, which may account for poor attachment of bacteria to media. No gas production as of April 1985. Aerobic lagoon doing most of cleanup now.

ARD Site #: CA-19 Number: 25

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Diamond S. Ranch, Waterford, CA
B. Contact Person: Tom or Wes Sawyer Phone: 209-874-2372
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 4/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 500 2: 0 3: 0
C. % Solids (if measured): 12 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 17 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED/FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 1000 Kwh Hours of Operation: 14 per day
B. Engine/Generator Set: Waukesha Gen Set
C. Engine Capacity: 75 Kw(e) Price/Kwh from Local Utility: $0.07
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Use of solid cover required external gas storage/used modif.AGBAG
B. Mechanical Failures:
CO2 scrubber installed but abandoned after 2 months
C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
U-shaped plugflow digester w/fixed fiberglass cover and external rubberbag gas storage. Designer:Landell Institute w/Farm Energy Co.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 27500.00
C. Annual Value of Other Benefits: $ 12000.00

VII. R&D Needs:

VIII. Other Comments:

System installed under cost-sharing between Farm Energy & Diamond S. Split proceeds from energy sales 60% Diamond S/40% to Farm Energy. Use custom-designed scraper to feed. System fills external bag two times/day, provides 14 hours of genset operation/day.

ARD Site #: CA-20 Number: 26

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): U

A. Site Name/Location: Modesto City Wastewater Plant, Modesto, CA
B. Contact Person: John Amstutz Phone: 209-577-5300
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 4/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: -0 2: -0 3: -0
B. Feedstock Type: SS Feed Quantity 1: -0 2: -0 3: -0
C. % Solids (if measured): -0 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: -0 2: -0 3: -0
C. Retention Time (days): 1: -0 2: -0 3: -0
D. Gas Use: OH
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set: none-gas used to operate vehicles
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
System installed to clean & compress gas from MSW plant to run city vehicles.
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Gas from sewage plant cleaned/stripped of CO2/comressed to 3000 psi & fed to 250 spec. modified vehicles to displace gasoline. Also to city bldg boilers
VI. Economic Viability:

A. Initial Capital Cost: $ 1600000.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:
Mech contracting by Pacific Lighting Indust,Montebello(213-725-1139). $1.6 million cost includes 2.7 mile gas pipeline to city hall/policestation. Has extensive scrubbing/cleaning of gas before compression. Has both quickfill & slowfill refueling stations, but quickfill has leakage and not being used.

ARD Site #: CA-21 Number: 27

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: City of Hercules Water treatment plant,Hercules, CA
B. Contact Person: Phone:
C. System Designer: OTH System Installer: OTH Current Status: NOP
D. Date Operational: 4/ 1/80 Date Non-Operational: 6/ 1/82

II. System Design Information:

A. Digester Type: OTH Capacity 1: 758 2: 0 3: 0
B. Feedstock Type: SS Feed Quantity 1: 1325 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 180

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set:
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $-0.0
D. Value of Purchased Fuel/Electricity Displaced:(1): -0.0 (2): -0.0 (3): -0.0

V. Operational History:

A. Major Design Problems and Solutions:
City set up integrated solar aquaculture/anaerobic filter MSW plant
B. Mechanical Failures:

C. Biological and Operational Problems:
Did not produce require BOD/COD reduction to meet wastewater cleanup regs.
D. System and Feedstock Characteristics:
Anaerobic filter covered by greenhouse for heating. Planned to use fish & plants for secondary treatment of city waste water.

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:
After system could not meet BOD/COD requirements, city decided to replace w/ conventional aerobic treatment facility.

ARD Site #: CO-1 Number: 28

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Lamar, CO
B. Contact Person: Bio-Gas of Colorado (Varani) Phone: 312-439-1530
C. System Designer: BOG System Installer: BOG Current Status: SDP
D. Date Operational: 3/15/76 Date Non-Operational: 3/15/79

II. System Design Information:

A. Digester Type: MPF Capacity 1: 22 2: -0 3: -0
B. Feedstock Type: BM Feed Quantity 1: 30 2: -0 3: -0
C. % Solids (if measured): 9 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: -0 2: -0 3: -0
C. Retention Time (days): 1: 15 2: -0 3: -0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set:
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Grit in Digester; shut down and clean - solution.
B. Mechanical Failures:
Alll components of digester rebuilt or redesigned.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
Solids refed to cattle.

VI. Economic Viability:

A. Initial Capital Cost: $ 35000.00 Other System Mod Costs: $ 200000.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:
Research and demonstration operation. Pilot scale for full-scale operation; Electricity production was planned and designed but equipment was never installed.

ARD Site #: CO-2 Number: 29

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: C.S.U Dairy Center, Fort Collins, CO
B. Contact Person: Ron Baker Phone: 303-482-5845
C. System Designer: SCRO System Installer: OTH Current Status: OP
D. Date Operational: 10/ 1/83 Date Non-Operational:

II. System Design Information:

A. Digester Type: MPF Capacity 1: 456 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 250 2: 0 3: 0
C. % Solids (if measured): 4 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 864 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Flush dairy; two additional mixers installed to prevent solids separation.
B. Mechanical Failures:
Boiler failed which heated digester; water froze on hypolon cover.
C. Biological and Operational Problems:
Temperature went down when the boiler failed. Odor control added benefit.
D. System and Feedstock Characteristics:
Installer: Heath Contruction. 250 dairy cows produce
500,000 lbs. of manure. Concrete PF digester with add-on agitators/mixers.

VI. Economic Viability:

A. Initial Capital Cost: $ 150000.00 Other System Mod Costs: $ 5000.00
B. Annual Op Costs: $ 7000.00 Annual Returns from Power Sales: $ 20000.00
C. Annual Value of Other Benefits: $ 12000.00

VII. R&D Needs:
Start-up problems common; need to have strong supervision until steady state.

VIII. Other Comments:
Efficient operating system that has already paid for itself. Odor control, sewage reduction costs, recycling are all added benefits. Liquid hauled out and spread on fields, but they still have not found a market for it.

ARD Site #: CT-1 Number: 30

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Sunny Valley Foundation Farm, Milford, CT
B. Contact Person: Connecticut Nature Conservancy Phone: 203-355-3715
C. System Designer: SCRO System Installer: ENCY Current Status: OP
D. Date Operational: 2/15/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 227 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 220 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 280 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 459 Kwh Hours of Operation: 17 per day
B. Engine/Generator Set: Waukesha VRG 220 (4 cycle) induction generator
C. Engine Capacity: 27 Kw(e) Price/Kwh from Local Utility: $0.06
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.04 (2): 0.05 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Engine overheating (no water in the system). Injectors installed.
B. Mechanical Failures:
20% down time over 2.5 yr period. Engine rebuilt; valve and pump problems.
C. Biological and Operational Problems:
Excess foaming/overflowing.
D. System and Feedstock Characteristics:
Two heat lines installed to prevent manure freeze-up.

VI. Economic Viability:

A. Initial Capital Cost: $ 121000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 8000.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Untrained manpower for operation; sub-standard engineering by SCRO.
Power generation consistently under design figures.
Disputes over hook up to electrical grid and pay back rate.

ARD Site #: FL-1 Number: 31

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Kaplan Industrial Feedlot, Bartow, FL
B. Contact Person: Mr. Kaplan/Mike Ricter Phone: 813-533-0685
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 7/15/79 Date Non-Operational: 12/ 1/82

II. System Design Information:

A. Digester Type: MTM Capacity 1: 1211 2: 1211 3: 0
B. Feedstock Type: BM Feed Quantity 1: 3000 2: 3000 3: 0
C. % Solids (if measured): 6 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 1416 2: 1416 3: 0
C. Retention Time (days): 1: 10 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Great fluctuations in animal population--500to 20,000. Feedlot built on site
B. Mechanical Failures:
Oner digester tank subsides so that it no longer holds liquid
C. Biological and Operational Problems:
When operated in thermophilic range(55C), system unstable at short (5day) HRT
D. System and Feedstock Characteristics:
Designed by Hamilton Standard for DOE. Use dedicated 75 HP biogas boiler to raise steam for digester heating. Biogas used for 500 HP feedlot boiler.

VI. Economic Viability:

A. Initial Capital Cost: $ 1500000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 200000.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 150000.00

VII. R&D Needs:

Operation of large digester in thermophilic range.

VIII. Other Comments:

Operator shut down digester because it cost $50K more/yr than value of gas produced. After 18 mos operation, had 10 ft of sand/grit in bottom of each digester. System design very complex, with large parasitic losses due to many pumps and stirrers.

ARD Site #: FL-2 Number: 32

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Jiffy Industries, Pensacola, FL
B. Contact Person: Newman Johnson Phone: 904-383-0781
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 6/ 4/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: MT Capacity 1: 74 2: 0 3: 0
B. Feedstock Type: SS Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 2 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 9 2: 0 3: 0
D. Gas Use: GV
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Removed Waukesha 817 (3-phase, 108V)/Perennial Energy.
C. Engine Capacity: 17 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
None.
B. Mechanical Failures:
Pump lost during bad freeze-up. (minor)
C. Biological and Operational Problems:
Nona.
D. System and Feedstock Characteristics:
Solar-heated, R-40 fiberglass tank. Batch loaded. Gen set removed because electrical output too low.

VI. Economic Viability:

A. Initial Capital Cost: $ 1250000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 100000.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Three systems installed to meet new FL poll. control regs. for sludge disp. Laws not being enforced, so demand for digester is low. Jiffy getting out of digester business. Dade City and Brooksville digesters ($3M@ incl. R&D) closed due to zoning decision.

ARD Site #: GA-1 Number: 33

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Hinson Brothers, Baldwin, GA
B. Contact Person: Rex Meyer, ENCY Hdqrts. Phone: 913-491-5300
C. System Designer: ENCY System Installer: ENCY Current Status: NI
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: Capacity 1: 340 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 100000 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

Design/engineering work completed.
Utility buy-back rates too low to justify installation.

ARD Site #: GA-2 Number: 34

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Dal-Ge Poultry Farm, Dews Pond Rd., Calhoun, GA
B. Contact Person: Gary Black Phone: 404-629-8692
C. System Designer: ARAT System Installer: OTH Current Status: OP
D. Date Operational: 8/15/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 1023 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 85000 2: 0 3: 0
C. % Solids (if measured): 6 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: ST/
B. Gas Prod (m3): 1: 778 2: 0 3: 0
C. Retention Time (days): 1: 42 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Recyled Olan Genset,just for peak shaving
C. Engine Capacity: 65 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Gas loss due to tank leakage; tank kept at lower pressure to reduce loss.
B. Mechanical Failures:
None.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
Feed rate 24m3/ day. 840m3 gas storage tank. Gas used to heat greenhouses and egg plant and to cool eggs; generator to supply feedmill when inst. and oper.

VI. Economic Viability:

A. Initial Capital Cost: $ 170000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 20000.00

VII. R&D Needs:

VIII. Other Comments:
TVA provided engineering assistance & 70K grant. Primary use for biogas is to run one 20ton & one 30ton absorption chiller for cold storage of lettuce and heating hypronic lettuce greenhouse. $20,000 in benefits is an estimate. Significant odor reduction/ fly control benefits.

ARD Site #: GA-3 Number: 35

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Mathis/P&M Farm, Social Circle, GA
B. Contact Person: Jim Walsh, GA Tech. Phone: 404-894-3636
C. System Designer: PREN System Installer: PREN Current Status: SDT
D. Date Operational: 10/ 1/83 Date Non-Operational: 6/ 1/84

II. System Design Information:

A. Digester Type: PF Capacity 1: 454 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 550 2: 0 3: 0
C. % Solids (if measured): 14 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 792 2: 0 3: 0
C. Retention Time (days): 1: 23 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 200 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Waukesha(6 cyl;3-phase;480V)/Perennial Energy-Marathon
C. Engine Capacity: 58 Kw(e) Price/Kwh from Local Utility: $0.03
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Severe gas leak; concrete cover poured in hot weather, shrunk and cracked. *
B. Mechanical Failures:
4-90 deg. elbows cause plugged lines;transfer overground not thru pump lines.
C. Biological and Operational Problems:
Sawdust/ manure formed scum layer; drained scum; float out sawdust.
D. System and Feedstock Characteristics:
* Roofing contractor currently fixing leaks; once fixed, gas and electricity production should increase substantially. Dilute manure (6%). Buried tank.

VI. Economic Viability:

A. Initial Capital Cost: $ 275000.00 Other System Mod Costs: $ 5000.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 50000.00

VII. R&D Needs:

VIII. Other Comments:

Operated 12/84-1/85; expected to restart 4/85. $28000/yr in electricity with load management, $2000 water heating, $20,000 saved on bedding (sawdust). Received $5.68/mo-Kw of effective (peak hour) capacity. Actual electricity prices: $.025/Kwh--sell, $.065--buy.

ARD Site #: HI-1 Number: 36

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Kona, HI
B. Contact Person: Dr. Young Phone: 808-948-8459
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 8/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: MPF Capacity 1: 100 2: 100 3: 100
B. Feedstock Type: PM Feed Quantity 1: 5000 2: 5000 3: 5000
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: OT
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None.
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
None known by extension agent.
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Red mud plastic digesters imported from Taiwan; modified Taiwanese process.

VI. Economic Viability:

A. Initial Capital Cost: $ 12000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Extension agent helped in installation.
Odor control is the major benefit.
More information should become available in the future.

ARD Site #: IA-1 Number: 37

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Heying Enterprises, West Union, IA
B. Contact Person: Carroll Anderson Phone: 319-422-3939
C. System Designer: OTH System Installer: OTH Current Status: NOP
D. Date Operational: 7/15/76 Date Non-Operational: 8/15/76

II. System Design Information:

A. Digester Type: MTC Capacity 1: 1893 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Non-insulated digester too cold.
B. Mechanical Failures:
Burned out two $30,000 heating units to keep 95 degree operating temperature.
C. Biological and Operational Problems:
High sulphur content in warm weather; scrubbers prohibitively expensive.
D. System and Feedstock Characteristics:
8" thick digester walls.
Designer/ Installer-- Sunny Time Energy.

VI. Economic Viability:

A. Initial Capital Cost: $ 200000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Initial cost ($150,000-$250,000) includes $50,000 DOE grant.

ARD Site #: IA-2 Number: 38

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Naser Brothers Farm, Sibley, IA
B. Contact Person: Roy Naser/Pete Temple (mngr.) Phone: 507-842-5262
C. System Designer: BOG System Installer: AOS Current Status: OP
D. Date Operational: 2/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 570 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 1000 2: 0 3: 0
C. % Solids (if measured): 5 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 623 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Settling pit problems and difficulties with heaters.
B. Mechanical Failures:
Decant pumps failed in settling pit; motors burned out; manure freezing.
C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
1000 sow farrow-to-finish (1,100,000 lbs).

VI. Economic Viability:

A. Initial Capital Cost: $ 170000.00 Other System Mod Costs: $ 10000.00
B. Annual Op Costs: $ 4000.00 Annual Returns from Power Sales: $ 30000.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Frequent power outages. Biogas boiler directly fires 26 space heaters.

ARD Site #: IA-3 Number: 39

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Mortimer-Rhinehart, Dallax Center, IA
B. Contact Person: Rex Meyer (ENCY headquaters) Phone: 913-491-5300
C. System Designer: ENCY System Installer: ENCY Current Status: NI
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 908 2: 908 3: 0
B. Feedstock Type: OTH Feed Quantity 1: 900 2: 55000 3: 5495
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.02
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

Feedstock 45 Mtons paunch manure, 990 BM, 55000 PM, 5450 tons cannery waste.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

Initial utility buy-back rates too low ($0.018/Kwh) to justify installation.
New Iowa legislation mandates $0.065 buy-back rate, but installation unlikely
Totally engineered system--considered very viable.

ARD Site #: IA-4 Number: 40

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Morgan Mugge Farm, Greenville, IA
B. Contact Person: Morgan Mugge (Rex Meyers) Phone: 712-262-4549
C. System Designer: ENCY System Installer: ENCY Current Status: NI
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 680 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 100000 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
100,000 pullet feedstock.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Owner considered installation but decided against.

ARD Site #: IA-5 Number: 41

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Winterset, IA
B. Contact Person: Bud Pearson/Rex Meyer Phone: 712-728-3342
C. System Designer: ENCY System Installer: ENCY Current Status: NI
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 80 2: 0 3: 0
B. Feedstock Type: Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced: (1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Thermophilic horizontal concrete digester.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Joint project of Energy Cycle & Abetong-Subema (Swedish).
Installation planned but never built.

ARD Site #: IA-6 Number: 42

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Grain Processing Corporation, Muscatine, IA
B. Contact Person: Tim Bezler Phone: 203-358-3548
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 5/ 1/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: UPB Capacity 1: 712 2: 712 3: 0
B. Feedstock Type: AW Feed Quantity 1: 768 2: 294 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 5200 2: 2100 3: 0
C. Retention Time (days): 1: 1 2: 1 3: 0
D. Gas Use: OT
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None.
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Second 2 digesters use finer sand, acheive greater loading cap & gas prod.
B. Mechanical Failures:
Down for one year, 1982-1983.
C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Soy protein waste, long SRT, short HRT. Two sets of two digesters.
Designed and installed by Dorr-Oliver.

VI. Economic Viability:

A. Initial Capital Cost: $ 2000000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 100000.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 460000.00

VII. R&D Needs:

VIII. Other Comments:

$260,000 in gas for grain drying. $200,000 in eliminated discharge surcharges
60% methane. D-O plans to build more digesters for effluent treatment/ gas recovery.

ARD Site #: IA-7 Number: 43

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Hamilton Farms, Iowa Falls, IA
B. Contact Person: Richard Vetter/ Fred Verani Phone: 312-439-1530
C. System Designer: AOS System Installer: AOS Current Status: OP
D. Date Operational: 8/15/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 567 2: 567 3: 0
B. Feedstock Type: PSM Feed Quantity 1: 124000 2: 0 3: 0
C. % Solids (if measured): 7 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 1415 2: 0 3: 0
C. Retention Time (days): 1: 21 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 2160 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Minneapolis Moline/Perennial Energy (Marathon)
C. Engine Capacity: 110 Kw(e) Price/Kwh from Local Utility: $0.04
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.06 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
None.
B. Mechanical Failures:
Cracked radiator; replaced magneto and rubber boots on check valves.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
9620m3 effluent storage tank filled and emptied onto fields twice a year.
120,000 chickens & 400 hogs farrow-to-finish (400m3/day).

VI. Economic Viability:

A. Initial Capital Cost: $ 313000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Labor and equipment savings for automated manure handling.
Actual electricity prices: $.039/Kwh--sell, $.058/Kwh--buy.

ARD Site #: IA-8 Number: 44

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Harold McCabe, Mt. Pleasant, IA
B. Contact Person: Mr. McCabe Phone: 319-385-4797
C. System Designer: OTH System Installer: OWN Current Status: OP
D. Date Operational: 7/15/72 Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 1000 2: 0 3: 0
C. % Solids (if measured): 1 % Feedstock BOD/COD Count (mg/1): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 25 2: 0 3: 0
D. Gas Use: GF
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: None
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Oversized burner (manuf. sized burner to boiler not load)--gas wasted. *
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
System run on propane not biogas. Heavily flushed; low solids.
* Cast iron plumbing refit with PVC.

VI. Economic Viability:

A. Initial Capital Cost: $ 2000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 5000.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
1st animal waste digester in US. 1972-$450/yr propane;1984-$4k-5k/yr propane.
All gas wasted, uneconomical to retrofit at this point.
Odor elimination, pollution control are the only benefits.
Owner built digester on design by E.P. TAganini (PhD dissertation, Iowa St.)

ARD Site #: IA-9 Number: 45

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Gregg Farm, Easterville, IA
B. Contact Person: John Gregg Phone:
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 4/15/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 710 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 800 2: 0 3: 0
C. % Solids (if measured): 10 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 566 2: 0 3: 0
C. Retention Time (days): 1: 21 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 720 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: John Deere 4020(repl. Waukesha)
C. Engine Capacity: 40 Kw(e) Price/Kwh from Local Utility: $0.02
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Major sulfide problem solved with scrubber.
B. Mechanical Failures:
Waukesha engine & pressure valves replaced after 10000 hrs. *
C. Biological and Operational Problems:
Problems with agitation and solids build up in unserground (buried) tanks. **
D. System and Feedstock Characteristics:
* Modified (w/factory LPG parts) John Deere 4020 tractor engine replaced Waukesha. **Insufficient agitation could result in solids build up.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 14000.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 4000.00

VII. R&D Needs:

VIII. Other Comments:
$4000 saved on electicity displaced; substantial reduction in pollution controls. Costs of installed system proprietary.

ARD Site #: IA-10 Number: 46

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Farmers Cooperative Elevator Co., Radcliffe, IA
B. Contact Person: Stuart Melvin Phone: 515-294-6360
C. System Designer: System Installer: Current Status: NOP
D. Date Operational: 5/15/81 Date Non-Operational: 11/ 1/83

II. System Design Information:

A. Digester Type: LAG Capacity 1: 33300 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 2500 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None.
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
System designed too large; never had enough cattle when they went on line. *
B. Mechanical Failures:

C. Biological and Operational Problems:
Probably not enough dilution water with manure.
D. System and Feedstock Characteristics:
Covered lagoon. Ray Crammond designed and installed. System neved installed correctly. No gas prod. measurements; little gas made.
VI. Economic Viability:

A. Initial Capital Cost: $ 125000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Economy in cattle business declined.
Did everything wrong getting it started; initial feed in lagoon was unsuitable, but it was covered anyways. The primary concern was odor control in response to a nuisance suit.

ARD Site #: IL-1 Number: 47

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Leefer Farm, Carlinville, IL
B. Contact Person: Mr. and Mrs. Leefer Phone:
C. System Designer: BOG System Installer: BOG Current Status: SDT
D. Date Operational: 8/15/80 Date Non-Operational: 8/15/82

II. System Design Information:

A. Digester Type: MTM Capacity 1: 570 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 1000 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: STH
B. Gas Prod (m3): 1: 1217 2: 0 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.03
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.06 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:
Pump shut-off failed, tank overfilled and pulled loose from concrete pad.
C. Biological and Operational Problems:
Considerable problems with sulfide; currently rebuilding second compressor.
D. System and Feedstock Characteristics:
Originally biogas was to fuel still. Now used for space heating, boiler, and grain drying. Feedstock 1000 BM, periodic stillage, intermittent cheese whey.

VI. Economic Viability:

A. Initial Capital Cost: $ 82000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 4000.00

VII. R&D Needs:

VIII. Other Comments:
$4k/yr LPG savings. Considering building genset and effluent re-feed system. New tank installed. Gas is being wasted while system is shut down.

ARD Site #: IN-1 Number: 48

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Joe Seyfert Farm, Huntertown, IN
B. Contact Person: Joe C. Seyfert Phone: 219-483-9521
C. System Designer: ARAT System Installer: OTH Current Status: NYO
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: MTC Capacity 1: 159 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 300 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Planned feedstock 6.1m3/day.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Primary motivation for installation is odor control and manure management. ARAT went out of business, leaving the digester near completion. Owner plans to complete installation summer '85.

ARD Site #: ME-1 Number: 49

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Colby Coop Starch Co., Caribou, ME
B. Contact Person: Ms. Denise Johnson (JOAT) Phone: 609-541-3505
C. System Designer: BIOT System Installer: BIOT Current Status: OP
D. Date Operational: 9/15/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: USB Capacity 1: 1798 2: 0 3: 0
B. Feedstock Type: OW Feed Quantity 1: 760 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 22000

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 2640 2: 0 3: 0
C. Retention Time (days): 1: 2 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
None.
B. Mechanical Failures:
Standard Maintenance.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
COD--20,000kg/day (22,000 mg/l); Feedstock: Potato starch waste at flowrate of 38 m3/hr.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Biothane Process. 85% COD reduction. 77% methane digester gas. Retention time 42 hours. Temporary shut down from 1981 until 1983 due to plant fire; started up again in 9/84. Runs sporadically due to erratic supply of potatoes (noncontinuous production results). Finances proprietary.

ARD Site #: ME-2 Number: 50

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: University of Maine Dairy Farm, Orono, ME
B. Contact Person: Dr. Stan Weeks Phone: 315-683-5814
C. System Designer: AGW System Installer: AGW Current Status: OP
D. Date Operational: 3/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 200 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 440 2: 0 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 450 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Ford
C. Engine Capacity: 23 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Vertical silo digester tank. Possible use of whey as feedstock.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
See NY-6.

ARD Site #: MD-1 Number: 51

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Oak Bluff Dairy, Woodsboro, MD
B. Contact Person: Glen Eaves /Rex Meyers (ENCY) Phone: 301-898-7098
C. System Designer: ENCY System Installer: ENCY Current Status: NYB
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 1136 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 1100 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

Low buy-back rate from utility; owner decided it was not financially viable. Probably will never be built.

ARD Site #: MD-2 Number: 52

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: U.S. Naval Academy, Gambrills, MD
B. Contact Person: Roland Peterson Phone: 301-987-0454
C. System Designer: System Installer: Current Status: NI
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 200 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Waukesha 200/ Perennial Energy (230V, 3-phase)
C. Engine Capacity: 27 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Project cancelled because too expensive and too complicated to build.

ARD Site #: MI-1 Number: 53

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Baum Dairy, Springport, MI
B. Contact Person: Dale Baum/Rex Meyer (ENCY) Phone: 517-531-4965
C. System Designer: ENCY System Installer: ENCY Current Status: OP
D. Date Operational: 6/15/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 684 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 400 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 1061 2: 0 3: 0
C. Retention Time (days): 1: 12 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 2160 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Martin Machinery; Waukesha
C. Engine Capacity: 90 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Digester not big enough to service 820 dairy cows, only 400.
B. Mechanical Failures:
Camshaft replaced on one of the generators; screen replaced in separator.
C. Biological and Operational Problems:
Heatlines installed to pre-heat digesters to prevent manure freeze-up.
D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ 220000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 15000.00 Annual Returns from Power Sales: $ 36000.00
C. Annual Value of Other Benefits: $ 40000.00

VII. R&D Needs:

VIII. Other Comments:
$220,000--bldgs.,dig.,genset,& solids recov. $40k/yr BED.
Owner saves considerably on extra equipment and not having to haul manure.
Owner would like to make farm self-sufficient by building larger digester.

ARD Site #: MI-2 Number: 54

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Fairgrove Farms, Sturgis, MI
B. Contact Person: Dave Pueschel Phone: 616-651-6646
C. System Designer: PREN System Installer: PREN Current Status: OP
D. Date Operational: 10/ 1/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 680 2: 0 3: 0
B. Feedstock Type: Feed Quantity 1: 575 2: 0 3: 0
C. % Solids (if measured): 11 % Feedstock BOD/COD Count (mg/1): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 991 2: 0 3: 0
C. Retention Time (days): 1: 21 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER/BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 100 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Caterpillar 3306 (460V, 3-phase)
C. Engine Capacity: 85 Kw(e) Price/Kwh from Local Utility: $0.03
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.09 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:
Engine leak in manifold cracked engine head. (85kW(e) 3-phase, 460 Cat 3306.
C. Biological and Operational Problems:
Sand trapped in feedstock caused heat exchanger to break.
D. System and Feedstock Characteristics:
No problem maintaining heat (95deg O.T.) or pH.

VI. Economic Viability:

A. Initial Capital Cost: $ 145000.00 Other System Mod Costs: $ 1300.00
B. Annual Op Costs: $ 25407.00 Annual Returns from Power Sales: $ 38517.00
C. Annual Value of Other Benefits: $ 18000.00

VII. R&D Needs:

VIII. Other Comments:
$2000 eng. fund; $15,000 depreciation. Operation amortized for 20 years.
$22,653 net income. Annual operating costs $2100 propane, $975 sand removal.

ARD Site #: MI-3 Number: 55

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: James Allison Farm, Custer, MI
B. Contact Person: Jerry Malstrom Phone: 616-843-4287
C. System Designer: OTH System Installer: OTH Current Status: SDP
D. Date Operational: 7/ 1/79 Date Non-Operational: 7/ 1/82

II. System Design Information:

A. Digester Type: PF Capacity 1: 222 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 225 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: OTH
B. Gas Prod (m3): 1: 400 2: 0 3: 0
C. Retention Time (days): 1: 10 2: 0 3: 0
D. Gas Use: EL
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 600 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Ford natural gas/ Onin
C. Engine Capacity: 25 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Patented a scum suppression system; resolved flotation problem. *
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Automated continuous feed. All electricity used on farm. Built two digesters, first one for test data. * Sun ate through plastic cover.

VI. Economic Viability:

A. Initial Capital Cost: $ 60000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Malstrom and Gene Dale designed and built the digesters, then sold the technology for approx. $4 million. Initial cost based on the final design. Supposedly a three-year payback was realized. Digester shut down when owner got out of farming. Malstrom hopes to develop modular 60-head digester unit.

ARD Site #: MI-4 Number: 56

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Green Meadow Farm, Elsie, MI
B. Contact Person: Velmer Green Phone: 517-862-5020
C. System Designer: ENCY System Installer: BMF Current Status: OP
D. Date Operational: 9/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 909 2: 909 3: 0
B. Feedstock Type: DM Feed Quantity 1: 1500 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: OTH
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 2500 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Two Minneapolis Moline
C. Engine Capacity: 220 Kw(e) Price/Kwh from Local Utility: $0.03
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Cost overruns.
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Hypalon cover. Commercial belt press doesn't dry solids adequately for bedding; working on improvement, still aren't using solids.

VI. Economic Viability:

A. Initial Capital Cost: $ 792000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 5400.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 125000.00

VII. R&D Needs:
Improved solids drying technology.

VIII. Other Comments:
Benefit estimate includes $36,000 el. savings, $70,000 bedding savings (fut.) and $19,000 fert. savings. Dig. liquids are the only fert. for 200-300 acres. Not included are revenues from 40 acres once devoted to manure handling.Owner hopes for 4-5 yr. payback. May install 3rd gen., since they have excess gas.

ARD Site #: MI-5 Number: 57

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Ludington, MI
B. Contact Person: Phone:
C. System Designer: ENHS System Installer: ENHS Current Status: OP
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 193 2: 0 3: 0
B. Feedstock Type: BM Feed Quantity 1: 350 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 30 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

ARD Site #: MI-6 Number: 58

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Jonesville, MI
B. Contact Person: Dale Baker Phone: 517-849-9815
C. System Designer: ENCY System Installer: ENCY Current Status: NYO
D. Date Operational: 4/ 1/85 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 189 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 160 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 14 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 700 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Lincoln Energy
C. Engine Capacity: 80 Kw(e) Price/Kwh from Local Utility: $0.04
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Steel digester tank laid on its side. 20' by 20' hypalon gas storage bag.

VI. Economic Viability:

A. Initial Capital Cost: $ 100000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
As of 3/20/85, digester ready to load; finishing touches on gen set.
Average electrical output is a prediction.
Projected 4.25 year payback.

ARD Site #: MI-7 Number: 59

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Roy Thompson Farms, Mecosta, MI
B. Contact Person: Michael Lafferty Phone: 616-706-0461
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 11/15/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 180 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 160 2: 0 3: 0
C. % Solids (if measured): 11 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 19 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER/BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 360 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: GM Citation/30 hp Dayton Elec. (home-built system)
C. Engine Capacity: 15 Kw(e) Price/Kwh from Local Utility: $0.02
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.10 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Still in shakedown phase; debris plugging bedding equipment; soap in digester
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ 60000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Went on line winter 84/85; gas/electricity production yet to reach design figures shown above. Estimated 4.5 year payback for energy production alone.

ARD Site #: MN-1 Number: 60

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Lindstrom Farm, Welch, MN
B. Contact Person: Duane Lindstrom Phone: 612-258-4425
C. System Designer: BOG System Installer: AOS Current Status: OP
D. Date Operational: 1/ 1/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 95 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 50 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 142 2: 0 3: 0
C. Retention Time (days): 1: 22 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 150 Kwh Hours of Operation: 9 per day
B. Engine/Generator Set: Waukesha 155 (1-phase, 230V, 6650hrs)/Perennial Energy
C. Engine Capacity: 16 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.08 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Installing new stirring mechanism to solve scum build-up problems.
B. Mechanical Failures:
Burned out genset valves at 5500hrs; overhauled eng.,rewired control panel.
C. Biological and Operational Problems:
Cold weather engine start-up a major problem.
D. System and Feedstock Characteristics:
Effluent fertilizes 80 acres of feed corn. Generates hot water for domestic use.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Major savings in fertilizer costs, using effluent on 80 acres of corn
Cost information not available.
AOS now working on the system and helping to pay for it as R&D.

ARD Site #: MN-2 Number: 61

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Larson Farm, Wyoming, MN
B. Contact Person: Verlo Larson/Dr. Phil Goodrich Phone: 612-464-2916
C. System Designer: OTH System Installer: OTH Current Status: SDP
D. Date Operational: 12/ 1/73 Date Non-Operational: 6/15/80

II. System Design Information:

A. Digester Type: MTM Capacity 1: 40 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 250 2: 300 3: 0
C. % Solids (if measured): 5 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 30 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Ford (80 hp, 6 cylinder)
C. Engine Capacity: 25 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Upright vertical digester impractical for northern climates
B. Mechanical Failures:
Army surplus RB for gas storage started to deteriorate after five years.
C. Biological and Operational Problems:
Sulfide scrubbing/removal problem.
D. System and Feedstock Characteristics:
Unstirred gasoline storage digester tank. U.Minn. operated, installed, and supplied. Designed by Prof. Phil Goodrich (he has add. brochures & info)

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

Pilot demonstration that never produced electricity. Owners (Larsons) out of the hog farm business; large fluctuation in digester efficency due to different management over the seven year period.

ARD Site #: MN-3 Number: 62

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Dennis Block, Harmony, MN
B. Contact Person: Kenny Bigalk Phone: 507-886-3472
C. System Designer: ARAT System Installer: OTH Current Status: NOP
D. Date Operational: 6/15/81 Date Non-Operational: 10/ 1/84

II. System Design Information:

A. Digester Type: MT Capacity 1: 31 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 50000 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: PB
B. Gas Prod (m3): 1: 396 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: OT
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 13 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Waukesha
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.02
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
No gas storage capabilities; more gas wasted than used.
B. Mechanical Failures:

C. Biological and Operational Problems:
General service and maintenance problems.
D. System and Feedstock Characteristics:
Feedstock 50,000 laying hens (3-6 ton). 1300 ft3 plastic gas storage bags.

VI. Economic Viability:

A. Initial Capital Cost: $ 100000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Alcohol still fired at one stage; insufficient gas to dry grain house.
Shut down due to lack of uses for biogas.

ARD Site #: MN-4 Number: 63

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: American Crystal Sugar Co., East Grand Forks, MN
B. Contact Person: Mr. Doug Ramsdell Phone: 218-773-1131
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 9/15/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 28500 2: 0 3: 0
B. Feedstock Type: AW Feed Quantity 1: 3800 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 10000

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 18300 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Epoxy-lined dome of digester has to be recoated periodically.
B. Mechanical Failures:

C. Biological and Operational Problems:
Some settling out of feedstock needs to be treated aerobically.
D. System and Feedstock Characteristics:
Feedstock: sugar beet waste-83,000 lbs./day. System Designer: Sergona (Swedish turnkey operation). Gas used as boiler fuel; 60%-85% methane.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

Digester unit runs 160-180 days/year (coincides with September harvest) supplements coal fired boiler. Big range in loading rates. All production rates and loading rates averages. For financial information contact:
Mr. Mark Richardson 101 N 3rd St. Moorhead, MN 56560 (request in writing).

ARD Site #: MN-5 Number: 64

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: American Crystal Sugar Co., Moorehead, MN
B. Contact Person: Phone: 218-236-4400
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 9/15/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 26600 2: 0 3: 0
B. Feedstock Type: AW Feed Quantity 1: 3800 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 18000 2: 0 3: 0
C. Retention Time (days): 1: 7 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Epoxy liner on digester dome has to be repeatedly resurfaced at high cost.
B. Mechanical Failures:
None.
C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
System Designer: Sergona (Swedish company); Installer: Hurst-Hendricks Construction Company (Fargo, ND). Side-entering agitation on MTM digester.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
See information sheet for MN-4.

ARD Site #: MN-6 Number: 65

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Butterfield Farm, Hokah, MN
B. Contact Person: Jeannie & Germaine Davidson Phone: 507-894-4272
C. System Designer: ARAT System Installer: ARAT Current Status: NYO
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: MT Capacity 1: 133 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 60 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: PB
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Gas-mixing equipment didn`t work as desired.
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Egg-shaped, in-ground, insulated digester. Plans to use gas first for hot water and space heating, then perhaps generator or greenhouse.

VI. Economic Viability:

A. Initial Capital Cost: $ 30000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
A few days work from completion; ARAT went out of business, difficulty finding someone to complete job.

ARD Site #: MN-7 Number: 66

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Cerise Farm, Kellog, MN
B. Contact Person: Benjamin Cerise Phone: 507-767-2254
C. System Designer: System Installer: Current Status: SDP
D. Date Operational: 6/15/80 Date Non-Operational: 9/15/80

II. System Design Information:

A. Digester Type: PF Capacity 1: 175 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 1300 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: OT
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
According to Mrs. Cerise: "the floor blew up" (no explanation).
B. Mechanical Failures:
Engine/genset purchased but it never produced electricty.
C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
1300 hog farrow-to-finish.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
The owner wanted to utilize the gas to dry grain and produce electricity but due to the explosion the digester was abandoned and it never produced electricity.

ARD Site #: MN-8 Number: 67

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Bill St.Sauver, Scandia, MN
B. Contact Person: Bill St.Sauver Phone: 612-433-2973
C. System Designer: OTH System Installer: OTH Current Status: SDP
D. Date Operational: 8/15/82 Date Non-Operational: 10/ 1/82

II. System Design Information:

A. Digester Type: PF Capacity 1: 102 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 70 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 85 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: planned International (4 cyl.)--never bought
C. Engine Capacity: 25 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:
Straw build-up, chopper pump bought, but too late.
D. System and Feedstock Characteristics:
Digester abandoned, full of straw. Urethane-lined steel tank.
Gas to be used for electrical generation and gas agitation.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Designer/ Installer, American Energy Recovery, went out of business shortly after installation. Owner was stuck with inoperative digester and no service.

ARD Site #: MO-1 Number: 68

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Blue River, 7300 E. Rochester Ave., Kansas City, MO
B. Contact Person: Jim Davis Phone: 816-231-8373
C. System Designer: BLVT System Installer: BLVT Current Status: NYO
D. Date Operational: 2/ 1/85 Date Non-Operational:

II. System Design Information:

A. Digester Type: MT Capacity 1: 374 2: 6259 3: 0
B. Feedstock Type: SS Feed Quantity 1: 20000 2: 0 3: 0
C. % Solids (if measured): 5 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 7 2: 7 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: None.
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Delays due to mixers;BV & mixer co. at odds over capabilities to run mixers.
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Primary purpose-stabilize sludge not reduce volume.Gas utilization secondary.
Gas to be scrubbed for storage and use if enough produced. 20,000 t/yr sludge
VI. Economic Viability:

A. Initial Capital Cost: $10000000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
$2.5 Mil.-dig. equip.; $2.5 mil.-dewatering plnt. Elec. prod. a possibility.
Chandler estimates gas production at 100,000 ft3/? at 25% solids.?
$150/ton dewatering vs. $50/ton stabilization.

ARD Site #: MO-2 Number: 69

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: University of Missouri, Columbia, MO
B. Contact Person: Dr. Gene Iannotti Phone: 314-882-7510
C. System Designer: OWN System Installer: OWN Current Status: SDT
D. Date Operational: 9/15/76 Date Non-Operational: 2/15/85

II. System Design Information:

A. Digester Type: MTC Capacity 1: 141 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 184 2: 60 3: 0
C. % Solids (if measured): 8 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 283 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FERT/FEED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 8 per day
B. Engine/Generator Set: Waukesha VRG-220/Perennial Energy
C. Engine Capacity: 22 Kw(e) Price/Kwh from Local Utility: $0.01
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.06 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Flush system too dilute; settling of manure.
B. Mechanical Failures:
Standard maintenance.
C. Biological and Operational Problems:
Mesophyllic; no problems.
D. System and Feedstock Characteristics:
Feedstock: swine (184) and beef cattle (60) manure. Designer: Dr. Jim Fischer
MT w/ concrete exterior and steel grain bin interior. Gas Storage: 300 ft3.

VI. Economic Viability:

A. Initial Capital Cost: $ 21000.00 Other System Mod Costs: $ 6000.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

Potentially can increase biogas by 1/3 (rate and net yield) with biology.

VIII. Other Comments:

Experimental unit; originally boiler/vented gas; now cogeneration.
Need to know how to work with more concentrated material (gutter flush is a potential solution). Cogeneration when operating is primary use, also alcohol still; gas storage inverted tank. System runs sporadically.

ARD Site #: MT-1 Number: 70

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): U

A. Site Name/Location: Montana Farms, Townsend, MT
B. Contact Person: Ralph Morand/Bob Hunter* Phone: 406-266-3776
C. System Designer: OTH System Installer: OTH Current Status: NYB
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 654 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 110000 2: 0 3: 0
C. % Solids (if measured): 9 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 1144 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 60 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Waukesha
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.04
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.05 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Not built yet.
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ 407000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 40000.00 Annual Returns from Power Sales: $ 4000.00
C. Annual Value of Other Benefits: $ 27000.00

VII. R&D Needs:

VIII. Other Comments:
Construction pending grant from the Montana Board of Natural Resources. Feasability study done by Brown & Caldwell, Bozeman, MT. *Contact: Bob Hunter (406) 586-3905. In addition to electricity, the biogas is used to heat the digester, space heating, egg washing and soil conditioner from solids waste.

ARD Site #: NH-1 Number: 71

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Ken Hadley`s Dairy Farm, Henniker, NH
B. Contact Person: Bill Hadley Phone: 603-428-7271
C. System Designer: OTH System Installer: OTH Current Status: SDT
D. Date Operational: 4/15/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 103 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 80 2: 0 3: 0
C. % Solids (if measured): 14 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 75 2: 0 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 100 Kwh Hours of Operation: 8 per day
B. Engine/Generator Set: Waukesha Model 155, 240 volt
C. Engine Capacity: 13 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Effluent supposed to gravityfeed from digester to lagoon but had freezing.
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Concrete plug-flow digester, fed w/manure from confined dairy cows. Preheat manure with hot water heat exchanger before add to digester.

VI. Economic Viability:

A. Initial Capital Cost: $ 45000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 3000.00
C. Annual Value of Other Benefits: $ 2000.00

VII. R&D Needs:

VIII. Other Comments:
System is slightly too small to be economically viable.
Owner moved to NY; current farm operations insufficient to run digester.
Hadley & Bennett, Henniker, NH designed and installed system.

ARD Site #: NH-2 Number: 72

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Shugah-Vale Farm, Claremont, NH
B. Contact Person: Don Clark Phone: 603-542-5277
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 6/15/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 178 2: 178 3: 178
B. Feedstock Type: DM Feed Quantity 1: 700 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 300 2: 300 3: 300
C. Retention Time (days): 1: 15 2: 15 3: 15
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 1600 Kwh Hours of Operation: 20 per day
B. Engine/Generator Set: Caterpillar 3306 (240V)/ Perennial Energy
C. Engine Capacity: 85 Kw(e) Price/Kwh from Local Utility: $0.06
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Have worked out probs with sand in pumps and separator.
B. Mechanical Failures:

C. Biological and Operational Problems:
Too short retention time.
D. System and Feedstock Characteristics:
Two hard-top, one soft-top concrete digesters.

VI. Economic Viability:

A. Initial Capital Cost: $ 200000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 30000.00
C. Annual Value of Other Benefits: $ 17000.00

VII. R&D Needs:

VIII. Other Comments:
Hadley and Bennett, Henniker, NH designed and installed digesters.
Bedding benefits $15000-$18000 per year.

ARD Site #: NJ-1 Number: 73

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Anheuser-Busch Brewing Co. East Brunswick, NJ
B. Contact Person: Ms. Denise Johnson (JOAT) Phone: 609-541-3505
C. System Designer: JOAT System Installer: JOAT Current Status: OP
D. Date Operational: 2/ 1/85 Date Non-Operational:

II. System Design Information:

A. Digester Type: USB Capacity 1: 2500 2: 2500 3: 0
B. Feedstock Type: OW Feed Quantity 1: 2496 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 20500

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 15600 2: 0 3: 0
C. Retention Time (days): 1: 2 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
None; shakedown phase with typical start-up problems.
B. Mechanical Failures:
Tank leaks; instrumentation panels need to be debugged.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
Feedstock: Yeast Waste, COD 51,400kg/day. Dual (parallel) tanks: total capacity: 5000 m3. Retention time: 48 hours.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Very large and efficient system; finances proprietary but biogas meeting well over 75% of production energy needs. Wastewater needs no secondary treatment.

ARD Site #: NM-1 Number: 74

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): U

A. Site Name/Location: Big Horn Construction, Clovis, NM
B. Contact Person: L.Skelley, D.Barrows, K.Puzey Phone: 505-769-2187
C. System Designer: PREN System Installer: OTH Current Status: NYO
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: LAG Capacity 1: 1900 2: 0 3: 0
B. Feedstock Type: OW Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 10 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Cornell-lined lagoon w/hypalon cover. Constructed by Big Horn Construction.
Feedstock liquid portion of fermented grain, stillage.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Digester gas supplements natural gas for grain distillation.
Built as of 1/28/85; startup tenatively schceduled for 5/1/85.

ARD Site #: NC-1 Number: 75

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Darrell Smith Farm, Princeton, NC
B. Contact Person: Darrell Smith Phone: 919-734-6107
C. System Designer: BOG System Installer: AOS Current Status: OP
D. Date Operational: 8/15/83 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 570 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 70000 2: 0 3: 0
C. % Solids (if measured): 6 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 453 2: 0 3: 0
C. Retention Time (days): 1: 25 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 633 Kwh Hours of Operation: 12 per day
B. Engine/Generator Set:
C. Engine Capacity: 80 Kw(e) Price/Kwh from Local Utility: $0.10
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Engine/generator set and cooling system were undersized.
B. Mechanical Failures:
Faulty casting caused cracked eng. head; control panel replaced due to H2S.
C. Biological and Operational Problems:
Biological problems when lagoon water fed into tanks.
D. System and Feedstock Characteristics:
Automatic system w/self feed/auto. start/auto. shutdown. Total solids: 25%in, 6%out. 1000 gal. gas storage. Wood chips/ iron shavings scrubber.

VI. Economic Viability:

A. Initial Capital Cost: $ 225000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 25980.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

Odor control and environmental concerns were the main reasons for installing a digester. Power sales a projection from two months' data.

ARD Site #: NC-2 Number: 76

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: North Carolina State University, Raleigh, NC
B. Contact Person: Jason C. H. Shih Phone: 919-737-2623
C. System Designer: OWN System Installer: OWN Current Status: SDT
D. Date Operational: 8/15/83 Date Non-Operational: 8/15/84

II. System Design Information:

A. Digester Type: PF Capacity 1: 15 2: 30 3: 0
B. Feedstock Type: PM Feed Quantity 1: 4000 2: 0 3: 0
C. % Solids (if measured): 6 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 5 2: 0 3: 0
D. Gas Use: GF
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Grit accumulation; used septic tanker pumper to remove grit.
B. Mechanical Failures:
None.
C. Biological and Operational Problems:
Operated in the thermophyllic range.
D. System and Feedstock Characteristics:
Primary and secondary digesters connected in series. Feedstock: 600kg manure from 4000 caged laying hens.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Earthen plug flow system, in ground lined with Red Mud Plastic and SolaRoll heating mat. Experimental unit with exceptional production (up to 4.5 m3/ m3/day); Shih will try to utilize gas for electrical production during second phase.

ARD Site #: NC-3 Number: 77

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Dixie Yeast, Gastonia, NC
B. Contact Person: Ms. Denise Johnson (JOAT) Phone: 609-541-3500
C. System Designer: BIOT System Installer: BIOT Current Status: OP
D. Date Operational: 8/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: USB Capacity 1: 1800 2: 0 3: 0
B. Feedstock Type: OW Feed Quantity 1: 1100 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 21000

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 4800 2: 0 3: 0
C. Retention Time (days): 1: 2 2: 0 3: 0
D. Gas Use: BB
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None.
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
None.
B. Mechanical Failures:
Standard maintenance.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
1800 m3 cylindrical digester tank (assumed to be metal). CM2Hill contractor. Hydraulic retention time 33 hours. COD load 18,600 kg/day, 55m3 feedstock/hr.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

Digester gas 70% methane; gas byproduct - wastewater treatment primary motivation for installation; digested liquid requires secondary treatment.

ARD Site #: ND-1 Number: 78

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Minn-Dak Farmers Co-op., Wahpeton, ND
B. Contact Person: John Groneman Phone: 701-642-8411
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 6/15/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 10640 2: 0 3: 0
B. Feedstock Type: AW Feed Quantity 1: 3800 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 4500

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 15000 2: 0 3: 0
C. Retention Time (days): 1: 3 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None.
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Accumulation of explosive gas in settling basin of overflow tank-fans helped.
B. Mechanical Failures:
Initial wastewater in open air clogged heat exchange; installed strainers.
C. Biological and Operational Problems:
Sludge wouldn't settle ocassionally; sludge had to be recycled aerobically.
D. System and Feedstock Characteristics:
Feedstock: beet sugar waste. Anamet process.
System Designer: Sergona; System Installer: Chicago Bridge & Iron Co.

VI. Economic Viability:

A. Initial Capital Cost: $ 1700000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 178000.00 Annual Returns from Power Sales: $ 70000.00
C. Annual Value of Other Benefits: $ 50000.00

VII. R&D Needs:

Corrosive gas & mositure eats away epoxy finish on interior of digester dome.

VIII. Other Comments:

System operates only 8 mos./year. Gas used to direct fire beet pulp dryers, the solids are sold a cattle feed, and to space heat the plant (as a supplementary heat source to coal). Wastewater treatment primary use of digester. Digester requires one man half-time to operate.

ARD Site #: ND-2 Number: 79

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: North Dakota State University Dairy, Fargo, ND
B. Contact Person: Dr. Jim Lindley Phone: 701-237-7273
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 12/ 1/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTC Capacity 1: 85 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 120 2: 0 3: 0
C. % Solids (if measured): 7 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: PB
B. Gas Prod (m3): 1: 100 2: 0 3: 0
C. Retention Time (days): 1: 11 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER/BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 240 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Army surplus
C. Engine Capacity: 10 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.05 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Flow blockage; replaced pipe elbow; installed influent solids separator.
B. Mechanical Failures:
Separator equipment needs some rebuilding.
C. Biological and Operational Problems:
Sunflower hulls used for bedding have settled out.
D. System and Feedstock Characteristics:
Rectangular tank w/center baffle; gas recirculation for mixing. Influent solids used for bedding. Gas used in boiler; generator heat recovery.

VI. Economic Viability:

A. Initial Capital Cost: $ 40000.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:
Design for electricity w/gas produciton not often reached; system often down. Initial 7 year payback projection.

ARD Site #: NY-1 Number: 80

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: R&M Dairy and Cheese, Hobart, NY
B. Contact Person: Fern/Tom Soule Phone: 607-538-0463
C. System Designer: OTH System Installer: OTH Current Status: SDT
D. Date Operational: 6/ 1/79 Date Non-Operational: 12/ 1/84

II. System Design Information:

A. Digester Type: PF Capacity 1: 500 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 300 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: PB
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 21 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FERT

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 3600 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Waukesha (6 cyl.)
C. Engine Capacity: 250 Kw(e) Price/Kwh from Local Utility: $0.07
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.04 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Crust build-up along walls; had to mix monthly.
B. Mechanical Failures:
Runs hot; blew head gasket ($5000).
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
Additional feedstock cheese whey--11m3/day (excellent for gas production).

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 30000.00
C. Annual Value of Other Benefits: $ 30000.00

VII. R&D Needs:

VIII. Other Comments:
Digester shut down when the 4 R&M Farms were sold. Now digester for sale. Planned to recirculate gas for mixing. $30,000 in fertilizer value. Additional cost information unavailable; other contact: Sonny Merwin (607) 538-9044.

ARD Site #: NY-2 Number: 81

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Crown Zellerbach Co., South Glens Falls, NY
B. Contact Person: David Healt Phone: 518-793-5684
C. System Designer: ECO System Installer: OWN Current Status: OP
D. Date Operational: 9/19/83 Date Non-Operational:

II. System Design Information:

A. Digester Type: UPB Capacity 1: 116 2: 0 3: 0
B. Feedstock Type: OTH Feed Quantity 1: 532 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 5000

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 8 2: 0 3: 0
C. Retention Time (days): 1: 1 2: 0 3: 0
D. Gas Use: GF
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None.
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:
150 deg., pH11 wastestream hard to digest, even after pretreatment. *
D. System and Feedstock Characteristics:
Paper mill wastewater feedstock. * Deficient in Fe and other metals; addition of metals improves performance, but is too costly. Two hour retention time.

VI. Economic Viability:

A. Initial Capital Cost: $ 245000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
CZ paid only $80,000; NY Energy & Dev. Auth. paid rest as part of pilot study
CZ installed digester for interim compliance with Dept. of Env. Cons. regulations; plans to sell digester in 12/85. Digester has never worked well; planned to use gas for boiler. Ecolotrol is publishing a study of the CZ dig.

ARD Site #: NY-3 Number: 82

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Milbrook Farm, Freeville, NY
B. Contact Person: Ron Space, Sr. Phone: 607-838-3509
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 12/ 1/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 227 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 200 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 540 2: 0 3: 0
C. Retention Time (days): 1: 30 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 550 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Ford (replaced Waukesha 27 Kw)
C. Engine Capacity: 35 Kw(e) Price/Kwh from Local Utility: $0.06
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.08 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Heat exchange system changed to apreheat digester input (cogeneration).
B. Mechanical Failures:
Valve overlap; scum drawn into and combustion chamber; carbonization.
C. Biological and Operational Problems:
Once added CuSO4 footbath solution which killed bacteria.
D. System and Feedstock Characteristics:
Heats house with genset.
Gravity-flow system.

VI. Economic Viability:

A. Initial Capital Cost: $ 75000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 4800.00
C. Annual Value of Other Benefits: $ 11000.00

VII. R&D Needs:

VIII. Other Comments:

Benefit figure includes $9500 in electricity displacement and $1500 in home heating value. Designed and installed by Cornell Ag. Eng., contact Dr.Larry Walker 607-256-4473. Cornell costs not included. DOE project, report due soon. 60 acres of fertilizer displacement.

ARD Site #: NY-4 Number: 83

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Canton Ag & Tech College, Canton, NY
B. Contact Person: Dr. Stan Weeks Phone: 315-683-5814
C. System Designer: AGW System Installer: AGW Current Status: OP
D. Date Operational: 6/ 1/83 Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 100 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 220 2: 0 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 230 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Waukesha
C. Engine Capacity: 13 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

See NY-6.

ARD Site #: NY-5 Number: 84

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Curtin Brothers Farm, Oneida, NY
B. Contact Person: Jack Curtin Phone: 315-363-1919
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 12/ 1/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 500 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 75 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Waukesha 817 (3-phase)/ Perennial Energy
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
System supposedly operating very well, producing gas and electricity.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
No other information available.

ARD Site #: NY-6 Number: 85

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): U

A. Site Name/Location: Agway Experimental Farm, Fabius, NY
B. Contact Person: Dr. Stan Weeks Phone: 315-683-5814
C. System Designer: AGW System Installer: AGW Current Status: OP
D. Date Operational: 6/ 1/83 Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 150 2: 0 3: 0
C. % Solids (if measured): 11 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 330 2: 0 3: 0
C. Retention Time (days): 1: 20 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER/BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 340 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Waukesha
C. Engine Capacity: 16 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Gas storage problems; compressor too exp. Cutter pumps to reduce matting.
B. Mechanical Failures:

C. Biological and Operational Problems:
Heavy metals (Cu) from another municipal/commerical dig. contaminated mix. *
D. System and Feedstock Characteristics:
Mixed silo tanks used for digester.
* Gas line/tank and manure freeze-up(cold barn); scraper stopped man.freezing

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Economic information unavailable. Daily gas production and electrical output for all Agway digesters is based on estimates of 70-85 ft3/cow and 2-2.5kWh/cow.

ARD Site #: NY-7 Number: 86

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): U

A. Site Name/Location: Ogdensburg, NY
B. Contact Person: Bruce Nichols Phone: 315-393-4508
C. System Designer: OTH System Installer: OTH Current Status: NYB
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 900 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 275 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 0 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED?

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Caterpillar 3306 (240V)/ Perennial Energy
C. Engine Capacity: 85 Kw(e) Price/Kwh from Local Utility: $0.06
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Soft-top concrete digester. Unmixed.

VI. Economic Viability:

A. Initial Capital Cost: $ 195000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Hadley and Bennett, Henniker, NH are to design and install digester.

ARD Site #: OK-1 Number: 87

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Thermonetics, Inc., Guymon, OK
B. Contact Person: Phone:
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 6/15/77 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTC Capacity 1: 7550 2: 7550 3: 0
B. Feedstock Type: BM Feed Quantity 1: 364 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 0 2: 0 3: 0
C. Retention Time (days): 1: 16 2: 16 3: 0
D. Gas Use: OT
E. Uses of Effluent/Other Byproducts: OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Designer/Installer--Cal Feed Corp./CMI Energy Conversion Systems, Inc.
Produce cattle feed from effluent--"Cal Feed. Protein Feed--$63/mton.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Feedstock production 364 metric tons/day.

ARD Site #: OK-2 Number: 88

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Braum Ice Cream Co. Dairy, Tuttle, OK
B. Contact Person: Coleman Zellnar Phone: 405-381-4427
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 1/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 5400 2: -0 3: -0
B. Feedstock Type: DM Feed Quantity 1: 4400 2: -0 3: -0
C. % Solids (if measured): -0 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: -0 2: -0 3: -0
C. Retention Time (days): 1: -0 2: -0 3: -0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: 3 Chicago pneumatics/ Allis-Chalmers (repl. 4 Cats.)
C. Engine Capacity: 4050 Kw(e) Price/Kwh from Local Utility: $0.02
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Solids now screened out; some plugging problems.
B. Mechanical Failures:
Replaced 4 Caterpillars after fire; they needed more reliable gensets anyway.
C. Biological and Operational Problems:
H2S problems.
D. System and Feedstock Characteristics:
Partition down the center lengthwise of 40'x300'x16' of gas-agitated concrete dig.. *Potential for 10000 m3/day gas. *Approx. 20000 kWh/day produced now.

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:

Detailed cost information unavailable. Digester has operated off and on so far. Only one of the three gensets is currently being used, because of insufficient load. Buy-back rates are too low to justify generating for the grid. They are expanding the load and plan to utilize full generation cap..

ARD Site #: PA-1 Number: 89

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Mason Dixon Farms, Inc., Gettysburg, PA
B. Contact Person: Bert and Richard Waybright Phone: 717-334-4056
C. System Designer: SCRO System Installer: ENCY Current Status: OP
D. Date Operational: 6/15/80 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 680 2: 680 3: -0
B. Feedstock Type: DM Feed Quantity 1: 700 2: 1000 3: -0
C. % Solids (if measured): 8 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: OTH
B. Gas Prod (m3): 1: 990 2: 0 3: -0
C. Retention Time (days): 1: 16 2: -0 3: -0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: BED/FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 2220 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: 2 Caterpillar G342s repl. Detroit Diesel aft 5500hrs
C. Engine Capacity: 300 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.06 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Orig. semi-flex. lid redesigned to support dig. pipes; now hypalon lid.
B. Mechanical Failures:
See IV.B.
C. Biological and Operational Problems:
Designed feedstock chopper to reduce scum. Flush system probs in cold weather
D. System and Feedstock Characteristics:
Effluent also used for silo cover.

VI. Economic Viability:

A. Initial Capital Cost: $ 180000.00 Other System Mod Costs: $ 80000.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ 68000.00
C. Annual Value of Other Benefits: $ 14000.00

VII. R&D Needs:
Improving methanogens. Improving manure handling and processing techs.

VIII. Other Comments:
Would choose underground concrete tank and slotted floor gravity manure collection system. Additional annual benefits approx. $3500 bedding, $9500 fertilizer nitrogen content. No power sold, figure is for cost displacement.

ARD Site #: PA-2 Number: 90

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Turkey Hill Dairy, Conestoga, PA
B. Contact Person: Cliff Frey Phone: 717-872-7190
C. System Designer: PREN System Installer: OTH Current Status: SDT
D. Date Operational: 6/ 1/83 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 1041 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 900 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: PB
B. Gas Prod (m3): 1: 1699 2: 0 3: 0
C. Retention Time (days): 1: 21 2: 0 3: 0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 2000 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Waukesha 1197 (3-phase, 480V)/ Perennial Energy
C. Engine Capacity: 105 Kw(e) Price/Kwh from Local Utility: $0.06
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.06 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Engine will be rebuilt due to the high sulphur content in gas.
B. Mechanical Failures:
Foreign matter in pump; piston rebuilt. Problems with heat exchange lines.
C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
38m3/day of feed. Solids are separated and sold as commercial cow manure.

VI. Economic Viability:

A. Initial Capital Cost: $ 150000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 5000.00 Annual Returns from Power Sales: $ 36000.00
C. Annual Value of Other Benefits: $ 22500.00

VII. R&D Needs:
Need to redesign heat exchange.

VIII. Other Comments:
Additional benefits from increased fertilizer value, and, when set up, heat recovery. Well managed system. 95% of electricity sold.

ARD Site #: PR-1 Number: 91

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Bacardi Corp., San Juan, PR
B. Contact Person: Don Felfier & Tom Morgan Phone:
C. System Designer: BLVT System Installer: BLVT Current Status: OP
D. Date Operational: 6/15/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: OTH Capacity 1: 1232 2: 0 3: 0
B. Feedstock Type: OW Feed Quantity 1: 1520 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 40000

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 48993 2: 0 3: 0
C. Retention Time (days): 1: 2 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Feedstock is high-strength stillage, 80C temp., w/pH of 4.5
B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Down-flow packed bed reactor. Rum stillage feedstock, 1291m3/day.

VI. Economic Viability:

A. Initial Capital Cost: $15000000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Gas management system includes gas collection and pressure control in each reactor and a two-stage compressor.

ARD Site #: PR-2 Number: 92

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Ubarri-Blanes Farm, Juana Diaz, PR
B. Contact Person: Dr. Donald Sasscer Phone: 809-832-1491
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 2/ 1/85 Date Non-Operational:

II. System Design Information:

A. Digester Type: MPF Capacity 1: 240 2: 240 3: -0
B. Feedstock Type: DM Feed Quantity 1: 320 2: -0 3: -0
C. % Solids (if measured): 10 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 400 2: -0 3: -0
C. Retention Time (days): 1: 30 2: -0 3: -0
D. Gas Use: EE
E. Uses of Effluent/Other Byproducts: FER/FEED/BED

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 1000 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Caterpillar/ Perennial energy
C. Engine Capacity: 40 Kw(e) Price/Kwh from Local Utility: $0.05
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.12 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:
Difficulty collecting desired amount of manure--cows less confined in tropics
D. System and Feedstock Characteristics:
Rectangular digester.

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:
Should have economic data available soon. A DOE project.
Overdesigned due to manure collection estimates based on temperate climate farming; second digester currently unused.

ARD Site #: TN-1 Number: 93

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): I

A. Site Name/Location: Cleek Dairy Farm, Route #1, Kingsport, TN
B. Contact Person: Philip A. Carpenter Phone: 615-694-0909
C. System Designer: System Installer: Current Status: NYB
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: -0 2: -0 3: -0
C. Retention Time (days): 1: -0 2: -0 3: -0
D. Gas Use:
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set:
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $-0.0
D. Value of Purchased Fuel/Electricity Displaced:(1): -0.0 (2): -0.0 (3): -0.0

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:

ARD Site #: TX-1 Number: 94

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Dept. of Ag, Tarleton State Univ., Stevensville, TX
B. Contact Person: Dr. Edward Fulton Phone: 817-968-9221
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 6/10/80 Date Non-Operational:

II. System Design Information:

A. Digester Type: MPF Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: PCS Feed Quantity 1: 3500 2: 100 3: 500
C. % Solids (if measured): 10 % Feedstock BOD/COD Count (mg/1): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 198 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set: Ford
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Third system built; mechanical problems have been solved.
B. Mechanical Failures:

C. Biological and Operational Problems:
Difficulty separating debris fr/feedstock. Once dig. stabilizes, pH&T no prob
D. System and Feedstock Characteristics:
Didn't try to keep out chlorine or other contaminants. Skilled help necessary

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:
Dr. Fulton in the process of writing state-of-the-art paper on PM/SM digs.

VIII. Other Comments:
University operation; costs/prod. variable.

ARD Site #: TX-2 Number: 95

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): U

A. Site Name/Location: Lubbock Feedlots, Lubbock, TX
B. Contact Person: Rex Meyers (ENCY) Phone: 913-491-5300
C. System Designer: SCRO System Installer: BMF Current Status: SDT
D. Date Operational: 6/15/83 Date Non-Operational: 8/15/84

II. System Design Information:

A. Digester Type: PF Capacity 1: 908 2: 908 3: 908
B. Feedstock Type: BM Feed Quantity 1: 40000 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: FG
B. Gas Prod (m3): 1: 15292 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: GF
E. Uses of Effluent/Other Byproducts: OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:
SCRO pumps replaced by BMF pumps; vibrating screens & belt press installed.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
Twelve 908m3 digesters. CO2 sold to Carbon Dioxode Tech., Inc. for enhancement of oil recovery. Methane is used to fuel the separation process.

VI. Economic Viability:

A. Initial Capital Cost: $23850000.00 Other System Mod Costs: $ 1000000.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Digester closed because CO2 Tech., Inc. went out of business and there was no market for the gas produced. Temporary shut down for new equipment/markets. $1,000,000 addition planned for production of electricity and production of pelleted feed. 15292 m3 of gas produced at shut down.

ARD Site #: TX-3 Number: 96

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Celanese Chemical Co., Bishop, TX
B. Contact Person: Tony Moores Phone: 617-494-7304
C. System Designer: CELN System Installer: CELN Current Status: OP
D. Date Operational: 6/15/80 Date Non-Operational:

II. System Design Information:

A. Digester Type: UPB Capacity 1: 4800 2: 0 3: 0
B. Feedstock Type: OT Feed Quantity 1: 3800 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 14000

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 16000 2: 0 3: 0
C. Retention Time (days): 1: 1 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: None
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Fixed-film reactor, same design and "Celrobic" technology as TX-6.
Feedstock is waste from 4 chemical plants. 80% COD removal efficiency

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Installed as a retrofit for cost savings, improved wastestream quality sufficiently to allow for surface water discharge.
Gas production figure is for methane only.
See TX-6.

ARD Site #: TX-4 Number: 97

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Carrell Brothers Farm, Godley, TX
B. Contact Person: Mr. Kirk Carrell Phone: 817-389-3551
C. System Designer: ENHS System Installer: OWN Current Status: OP
D. Date Operational: 1/18/85 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 453 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 600 2: 0 3: 0
C. % Solids (if measured): 10 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 2476 2: 0 3: 0
C. Retention Time (days): 1: 25 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 500 Kwh Hours of Operation: 16 per day
B. Engine/Generator Set: Waukesha/Lima (3-phase)
C. Engine Capacity: 65 Kw(e) Price/Kwh from Local Utility: $0.03
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.05 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
None.
B. Mechanical Failures:
Motor magneto replaced.
C. Biological and Operational Problems:
Lime added during start-up, no problems since.
D. System and Feedstock Characteristics:
May add second agitator (now moved end-to-end every mo.). Only 1/3 of manure now loaded - 11 m3/day. Installing separator for solids to be used for feed.

VI. Economic Viability:

A. Initial Capital Cost: $ 150000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 3300.00
C. Annual Value of Other Benefits: $ 12000.00

VII. R&D Needs:

VIII. Other Comments:
$12000 in electricity use displacement should increase with addition of an automatic start-up/shut down unit to match milking loads. Electrical output based on estimated generation at 50% capacity. Elec. prices: $0.25-sell $.045-buy. Owner satisfied with digester; no use for solids as bedding.

ARD Site #: TX-5 Number: 98

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Del Valle Hog Farm, Del Valle, TX
B. Contact Person: Dan Raley Phone: 512-247-3900
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 7/ 1/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTC Capacity 1: 113 2: 0 3: 0
B. Feedstock Type: SM Feed Quantity 1: 1200 2: 0 3: 0
C. % Solids (if measured): 7 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: OTH
B. Gas Prod (m3): 1: 170 2: 0 3: 0
C. Retention Time (days): 1: 16 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set: Kaylor
C. Engine Capacity: 6 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.07 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Concrete-fiberglass interface seal.
B. Mechanical Failures:

C. Biological and Operational Problems:
2m3 FeO H2S scrubber insufficient to prevent yearly compressor replacement.
D. System and Feedstock Characteristics:
Most gas used for 3 hot water heaters, space and digester heating. Gen too expensive to use except as back-up to main supply (high maint costs).

VI. Economic Viability:

A. Initial Capital Cost: $ 60000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
If all gas were used, a 4 yr payback would be realized. Much gas now flared during warm months. Benefits include elim of $4000/yr butane costs and a cleaner and warmer farm. Some problems with gas-agitation mixing; as noted, H2S probs require stringent maint. A DOE Project.

ARD Site #: TX-6 Number: 99

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Celanese Chemical Co., Vernon, TX
B. Contact Person: Tony Moores Phone: 617-494-7304
C. System Designer: CELN System Installer: CELN Current Status: OP
D. Date Operational: 7/ 1/77 Date Non-Operational:

II. System Design Information:

A. Digester Type: UPB Capacity 1: 1600 2: 0 3: 0
B. Feedstock Type: OT Feed Quantity 1: 1200 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 14000

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 4000 2: 0 3: -0
C. Retention Time (days): 1: 1 2: -0 3: -0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set: None
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Materials are critical; CELN has split two concrete digesters. **
B. Mechanical Failures:

C. Biological and Operational Problems:
Reactor plugged with excess microorganisms in 1979; process developed *
D. System and Feedstock Characteristics:
Fixed-film reactor; "Celrobic" technology; feedstock is waste guar bean thickening agent. *to determine optimum microorg. levels and to remove excess

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:
Gas prod. figure is for CH4. COD removal efficiency 65%. Retrofit install.

VIII. Other Comments:
** Other design modifications include improvements in instrumentation, collection, distribution, and mixing systems. Scale-up from pilot plant not an easy process. Article in "Ind. Waste", Vol.29, #2, Mar/Apr 1983. Propr. design, cost info avail upon written inquiry. Badger Co., eng consults

ARD Site #: TX-7 Number: 100

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): C

A. Site Name/Location: Celanese Chemical Co., Pampa, TX
B. Contact Person: Tony Moores Phone: 617-494-7304
C. System Designer: CELN System Installer: CELN Current Status: OP
D. Date Operational: 7/ 1/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: UPB Capacity 1: 4800 2: 0 3: 0
B. Feedstock Type: Feed Quantity 1: 3800 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 12000

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 15000 2: -0 3: -0
C. Retention Time (days): 1: -0 2: -0 3: -0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set: None
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
C1-C5 oxygenated hydrocarbons as feedstock. Same design and "Celrobic" technology as TX-6. 90% COD removal efficiency.

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:

Installed as a retrofit to control air pollution, improved wastestream quality to allow for surface water discharge.
See TX-6.
Gas production figure is for methane only.

ARD Site #: VT-1 Number: 101

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Foster Brothers Farm, Middlebury, VT
B. Contact Person: Bob Foster Phone:
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 690 2: -0 3: -0
B. Feedstock Type: DM Feed Quantity 1: 600 2: -0 3: -0
C. % Solids (if measured): -0 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: RB
B. Gas Prod (m3): 1: 790 2: -0 3: -0
C. Retention Time (days): 1: 20 2: -0 3: -0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: BED/FER/OTH

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 1600 Kwh Hours of Operation: 14 per day
B. Engine/Generator Set: Caterpiller Natural Gas Engine
C. Engine Capacity: 125 Kw(e) Price/Kwh from Local Utility: $0.09
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
No major problems to date
B. Mechanical Failures:
pumps
C. Biological and Operational Problems:
Digester instability when experimented w/addition of cheese whey
D. System and Feedstock Characteristics:
System designed by Hadley/Bennett, Henniker, N.H. Feedstock from 600 confined dairy cows,although numbers now down due to PIK program.

VI. Economic Viability:

A. Initial Capital Cost: $ 185000.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ 8000.00 Annual Returns from Power Sales: $ 40000.00
C. Annual Value of Other Benefits: $ 12000.00

VII. R&D Needs:

VIII. Other Comments:
Digester Effluent is run through screw-type dewaterer, and then used as bedding, resulting is lower mastitis rate. Liquid effluent spread on fields by irrigation guns. Experimenting w/sale of solids to nurseries as planting media and potting soil

ARD Site #: WA-1 Number: 102

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Department of Corrections, Monroe, WA
B. Contact Person: Institutional Industries Div. Phone: 206-794-8503
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 7/15/77 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTC Capacity 1: 209 2: -0 3: -0
B. Feedstock Type: DM Feed Quantity 1: 275 2: -0 3: -0
C. % Solids (if measured): 85 % Feedstock BOD/COD Count (mg/l): -0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 600 2: -0 3: -0
C. Retention Time (days): 1: 14 2: -0 3: -0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Old system; needs updated equipment to be economical.
B. Mechanical Failures:
Sawdust clogging lines; standard maintenance.
C. Biological and Operational Problems:
Low methane production/quality.
D. System and Feedstock Characteristics:
System Designer: Ecotope Group, Seattle. Insulated silo with mix concrete pit digester; 25hp boiler produces steam for creamery (60%) & reheat silo (40%).

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ 7500.00 Annual Returns from Power Sales: $ 10560.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:
Analyze the economic feasibility for electrical production.

VIII. Other Comments:
Currently operating in the red; will most probably be shut down in the near future. $880.00/mo in savings when operating at maximum level.

ARD Site #: WA-2 Number: 103

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Bill's Dairy, Bothell, WA
B. Contact Person: Bill Knutsen Jr. Phone: 206-488-3854
C. System Designer: OTH System Installer: OTH Current Status: OP
D. Date Operational: 6/ 1/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: MPF Capacity 1: 205 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 185 2: 0 3: 0
C. % Solids (if measured): 12 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 198 2: 0 3: 0
C. Retention Time (days): 1: 14 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Metallurgical contamination of gas in compressor; scrubbers too expensive.
B. Mechanical Failures:
Standard maintenance.
C. Biological and Operational Problems:
None. Gas production; 1 vol./vol./day.
D. System and Feedstock Characteristics:
System Designer/Installer: Mark Slosberg, Methanogens Fuels Corp., Seattle, WA. Feedstock: 3500 gls. manure/day; 185 cows; system capacity 225 cows.

VI. Economic Viability:

A. Initial Capital Cost: $ 125000.00 Other System Mod Costs: $ 1500.00
B. Annual Op Costs: $ 4000.00 Annual Returns from Power Sales: $ 9000.00
C. Annual Value of Other Benefits: $ 5000.00

VII. R&D Needs:

VIII. Other Comments:

Gas used to fire boiler for steam pasteurization of milk. After solids separation; liquids hauled away and solids mixed with sawdust and sold as soil conditioner (less odor and better sales due to treatment). Digester works well isn't labor intensive (1 hr. labor/day) but requires high maintenance.

ARD Site #: WI-1 Number: 104

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): U

A. Site Name/Location: Bob Kallian, Granston, WI
B. Contact Person: Peter Widmar Phone: 715-238-7773
C. System Designer: ARAT System Installer: ARAT Current Status: OP
D. Date Operational: 11/ 1/84 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTC Capacity 1: 133 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 65 2: 0 3: 0
C. % Solids (if measured): 12 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 113 2: 0 3: 0
C. Retention Time (days): 1: 32 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 24 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Manure transfer freeze-up; waste heat used to heat digester.
B. Mechanical Failures:
Computer controlled pressure and flame outlets for still not functioning.
C. Biological and Operational Problems:
Insufficient gas production for volume of feedstock.
D. System and Feedstock Characteristics:
Dairy manure feed of 5.6m3/day. 3(1000gls.) metal tanks for compressed gas.
Gas used for alcohol still (corn fed), boiler, digester, and space heat.

VI. Economic Viability:

A. Initial Capital Cost: $ 18000.00 Other System Mod Costs: $ 40000.00
B. Annual Op Costs: $ 1200.00 Annual Returns from Power Sales: $ 3600.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

Enzymatic research to increase and speed up gas production.

VIII. Other Comments:

Computer should have manual over-ride - beacuse after $40k installation, it still does not function for the still operation. Digesters should be in an insulated shed and wastewater from still can be used to heat digester tank and add to manure.

ARD Site #: WI-2 Number: 105

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Fertile Acres Farms, Rice Lake, WI
B. Contact Person: Lynn Shieffer* Phone: 715-234-2912
C. System Designer: ENHS System Installer: ENHS Current Status: NOP
D. Date Operational: 6/15/78 Date Non-Operational:

II. System Design Information:

A. Digester Type: PF Capacity 1: 153 2: 0 3: 0
B. Feedstock Type: DM Feed Quantity 1: 125 2: 0 3: 0
C. % Solids (if measured): 20 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type: NON
B. Gas Prod (m3): 1: 113 2: 0 3: 0
C. Retention Time (days): 1: 15 2: 0 3: 0
D. Gas Use: EO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 25 Kwh Hours of Operation: 10 per day
B. Engine/Generator Set: Waukesha
C. Engine Capacity: 12 Kw(e) Price/Kwh from Local Utility: $0.03
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.04 (2): 0.06 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Poor design and pump problems in material handling system.
B. Mechanical Failures:
Standard maintenance.
C. Biological and Operational Problems:
None.
D. System and Feedstock Characteristics:
Expandable hypolon cover.

VI. Economic Viability:

A. Initial Capital Cost: $ 35000.00 Other System Mod Costs: $ 40000.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:
Only operating on-farm anaerobic digester in Wisconsin at one time, management problems caused shut down. *Information contacts: i/e Assoc. - Tom Abels or David Ellsworth, (612) 721-5066 or Don Wichert Wisc. DOE (608) 266-7312.

ARD Site #: WI-3 Number: 106

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information

Form Status (C, I, U): I

A. Site Name/Location: Heileman Brewing Co., LaCrosse, WI
B. Contact Person: Jack Isherwood Phone: 608-785-1000
C. System Designer: JOAT System Installer: JOAT Current Status: OP
D. Date Operational: 6/15/81 Date Non-Operational:

II. System Design Information:

A. Digester Type: USB Capacity 1: 4200 2: 0 3: 0
B. Feedstock Type: OW Feed Quantity 1: 23708 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 2500

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: 24000 2: 0 3: 0
C. Retention Time (days): 1: 1 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: NON

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
Concrete tank. Retention time 5 hours.
Digester gas is 75% methane. Feedstock brewery waste.

VI. Economic Viability:

A. Initial Capital Cost: $ 0.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 0.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 0.00

VII. R&D Needs:

VIII. Other Comments:

Heileman uses propriety biothane process; COD reduction of 90%.
Need more information on operational history and financial information.

ARD Site #: WI-4 Number: 107

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Ore-Ida, Plover, WI
B. Contact Person: Dennis Swearington/Dave Jensen Phone: 715-421-3400
C. System Designer: JOAT System Installer: JOAT Current Status: OP
D. Date Operational: 9/ 1/82 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTM Capacity 1: 2200 2: -0 3: -0
B. Feedstock Type: OW Feed Quantity 1: 2998 2: -0 3: -0
C. % Solids (if measured): -0 % Feedstock BOD/COD Count (mg/l): 2000

III. System Performance Information:

A. Gas Storage Type: ST
B. Gas Prod (m3): 1: 5500 2: -0 3: -0
C. Retention Time (days): 1: 1 2: -0 3: -0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set:
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:
Influent T (110-120 degrees F) and COD (15-2000 mg/l) far from design specs.
B. Mechanical Failures:
H2S corroded fittings and necessitated new roof supports and baffles.
C. Biological and Operational Problems:
Initial problems with pH balance.
D. System and Feedstock Characteristics:
Feedstock: potato cooking waste (2998 m3/day). H2S scrubber installed.
Hydraulic retention: 17 hrs. Hydraulic flow: 3119 m3/day

VI. Economic Viability:

A. Initial Capital Cost: $ 1500000.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ 120000.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ 200000.00

VII. R&D Needs:

VIII. Other Comments:
1.4 person/yrs - labor. $120k to balance pH. Biogas 75% methane displaces 140-245000 ft3 (4000-7000 m3/day) propane gas that would be used for production; effluent spread on 240 acres of adjacent grassland.

ARD Site #: WI-5 Number: 108

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Ripon, WI
B. Contact Person: Wayne Gibbons Phone: 414-748-5836
C. System Designer: OWN System Installer: OWN Current Status: OP
D. Date Operational: 8/ 1/78 Date Non-Operational:

II. System Design Information:

A. Digester Type: MTC Capacity 1: 97 2: 0 3: 0
B. Feedstock Type: PM Feed Quantity 1: 16000 2: 0 3: 0
C. % Solids (if measured): 11 % Feedstock BOD/COD Count (mg/l): 119

III. System Performance Information:

A. Gas Storage Type: OTH
B. Gas Prod (m3): 1: 84 2: 0 3: 0
C. Retention Time (days): 1: 40 2: 0 3: 0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts: FER

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: 0 Kwh Hours of Operation: 0 per day
B. Engine/Generator Set:
C. Engine Capacity: 0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:
Emptying digester from the top has resulted in excessive sand build-up.
D. System and Feedstock Characteristics:
Digester gas 62% methane. Gas used for boiler, hot water, and home heating.
Gas storage with floating fiberglass-lined steel cover.

VI. Economic Viability:

A. Initial Capital Cost: $ 12000.00 Other System Mod Costs: $ 0.00
B. Annual Op Costs: $ 5000.00 Annual Returns from Power Sales: $ 0.00
C. Annual Value of Other Benefits: $ 1200.00

VII. R&D Needs:
Manure handling equipment is either too big or too small.

VIII. Other Comments:
Biggest problem has been the high cost of manure handling equipment.
System based on design from India by Rambuck Zhing (spelling uncertain).

ARD Site #: WI-6 Number: 109

COMMERCIAL-SCALE ANAEROBIC DIGESTION SYSTEM WORKSHEET

I. Identification Information Form Status (C, I, U): C

A. Site Name/Location: Beloit, WI
B. Contact Person: Tony Moores Phone: 617-494-7304
C. System Designer: CELN System Installer: CELN Current Status: OP
D. Date Operational: 1/ 1/85 Date Non-Operational:

II. System Design Information:

A. Digester Type: UPB Capacity 1: 0 2: 0 3: 0
B. Feedstock Type: OT Feed Quantity 1: 0 2: 0 3: 0
C. % Solids (if measured): 0 % Feedstock BOD/COD Count (mg/l): 0

III. System Performance Information:

A. Gas Storage Type:
B. Gas Prod (m3): 1: -0 2: -0 3: -0
C. Retention Time (days): 1: -0 2: -0 3: -0
D. Gas Use: BO
E. Uses of Effluent/Other Byproducts:

IV. Power Generation/Gas Utilization:

A. Ave Electrical Output: -0 Kwh Hours of Operation: -0 per day
B. Engine/Generator Set:
C. Engine Capacity: -0 Kw(e) Price/Kwh from Local Utility: $0.00
D. Value of Purchased Fuel/Electricity Displaced:(1): 0.00 (2): 0.00 (3): 0.00

V. Operational History:

A. Major Design Problems and Solutions:

B. Mechanical Failures:

C. Biological and Operational Problems:

D. System and Feedstock Characteristics:
"Celrobic" technology; see TX-6.

VI. Economic Viability:

A. Initial Capital Cost: $ -0.00 Other System Mod Costs: $ -0.00
B. Annual Op Costs: $ -0.00 Annual Returns from Power Sales: $ -0.00
C. Annual Value of Other Benefits: $ -0.00

VII. R&D Needs:

VIII. Other Comments:
Additional Celrobic digester installed in Japan in 1984.